The Monthly Review

Published by the AMERICAN ELECTRO-PLATERS' SOCIETY

APRIL 1937

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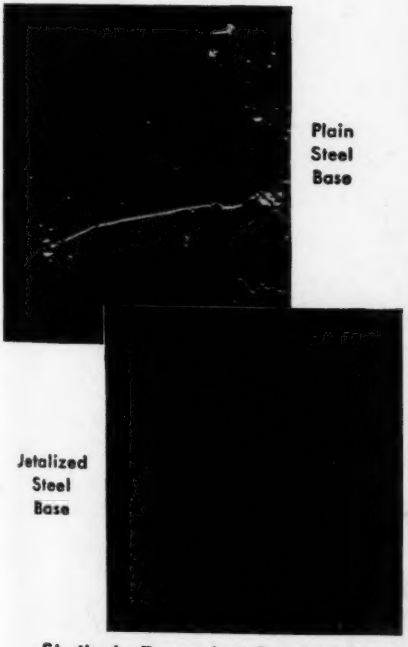

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Published by the AMERICAN ELECTRO-PLATERS' SOCIETY

A Society for the Advancement of the Science of Electro-Plating

APRIL 1937

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We are pleased to dedicate this issue of the REVIEW *to the Officers and Members of Los Angeles and San Francisco branches. Space will not permit publishing all the papers read at the Los Angeles Annual Meeting but they will be published in a later issue.*

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Editorial

In this ever changing world of ours the only changeless thing is the fact that everything changes with time. We of course have no intention of including in this change the fundamental or basic laws of Nature, since thanks to their Authorship they were so wisely designed that they have anticipated all change, altho even now new and radically different applications are made from time to time.

Speaking of laws brings home to us the Constitution under which our Organization conducts its affairs. From year to year additions and changes have been found advisable to simplify the disposal of our problems. The results have been that in the past your Secretaries have had a neck and neck race to keep the current edition of the Constitution up to date, and with all due respect to these gentlemen the possibility has arisen that some of these measures have fallen by the wayside.

Simultaneous with the necessity of publishing a new supply of copies of our Constitution for the use of our ever increasing membership, the thought occurred that it would be well to appoint a Committee for the purpose of comparing the present edition of our Constitution with the legislation that has been recorded from year to year in the minutes of our business sessions.

With this in mind, our Past President, Mr. T. F. Slattery was requested and has agreed to act as Chairman of this Committee.

He was given the privilege of personally selecting his coworkers and reports the following gentlemen as accepting his request to serve with him: Mr. Walter Fraine, Mr. Frank Hanlon, Mr. George Hogaboom, Mr. W. J. R. Kennedy and Mr. Oscar Servis. From your knowledge of the ability of these gentlemen and their sincerity of endeavor in increasing the usefulness of our Society, you may anticipate a very complete report to be read at the New York Convention.

It is a conceded conclusion that this Committee or any other group of members do not have the power to alter or add one word to our present legislation, but if during their study they may find some obvious error, change in phraseology, or completely new regulation advisable, we should be only too glad to profit by their findings when reported next June, and plan to incorporate their suggestions in our Constitution at some Convention in the near future.

With all due respect to our past Law Committees and Conventions, our present Constitution has been added to in much the same manner as alterations to a rambling homestead where the need for increased capacity and changed conditions have occasioned a new room or the removal of a partition. May we look upon this Committee as a group of consulting architects drawing up plans to make this residence of ours a beautiful and homogeneous unit.

We are approaching the 25th Annual meeting of our Society, an organization that has weathered the storms in a very credable manner, which proves the stability of our foundation, namely the education of others in our particular profession.

In school training we do not wait until our children have grown up before undertaking to teach them the fundamentals so necessary for their lifework. We have recognized this fact in the admission of the assistant foreman to our ranks. What are we doing about it at this time? From an analysis of the last Membership report we find that 26 members were elected as Active and that 19 were elected as Associate Members. This is a fine showing — 45 members in one month, but upon looking over the branches to whom these elections were credited we noted less than half the branches in our organization as represented. We will agree with the fact that these unrepresented branches may have exhausted the potential field for active members in their area, but have their members brought within the ranks of their Branch the assistants who are relieving them of so much detail work?

The life of any organization depends on going forward, both in achievements and numerical strength. The life of a hospital patient depends to a large extent on his personal desire to recover. "Doctors" Eichstaedt and Hanlon stand ready to administer the proper brands to tonic to boost membership and make your meetings more profitable through speakers and suggestions. Look in

the mirror, feel your pulse, take stock of your branch and call the proper department to help your case and insure an 100 per cent recovery of interest.

The resort to prejudice instead of reason never has and never will offer permanent solutions to any of our problems. Let this our Silver Jubilee pave the way to a better conception as to what our Society owes to the Industry and to how we may become better stewards of the trust imposed on us by our next door neighbor.

E. STEEN THOMPSON

MESSAGE TO MEMBERS

As First Vice-president, I wish to say to all the members that I shall endeavor in every way to fulfill the duties of my office to the best of my ability and to the expectations of my friends. I feel very grateful for the opportunity of serving the Society, and thankful to my many friends who have sent in congratulatory letters.

As Chairman of the New Membership Committee, I wish to state that the drive is progressing very successfully. All but a few branches have put forth strenuous efforts and are showing good results. No matter how successful the drive may seem to be, there are still two months before the end of the fiscal year, and many more new members should be added to each branch. There should be no let-up at this time.

The Branch Chairmen are working earnestly and doing very well. But are you, as an individual, doing all you can? Have you asked every one of your friends that you come in contact with and are eligible for membership to join the Society? Have you given him an application? If you have not, then do it now! Regarding the suspended members, have you not some interest in getting some of them re-instated? Can you not approach some one of them personally? You know that by their paying $6.00 for one year's dues in advance, they will be in good standing again. To sum it all up, by your active part in this work and personal contact, you are not only increasing the membership, but you are doing your friend a great service, and making him realize it by becoming a member, and he is showing his appreciation. Every one of you can bring in someone. Do it now.

Sincerely yours,

T. C. EICHSTAEDT.

The Present Status *of* Electrodeposition *of* Tungsten *from* Aqueous Plating Baths

By M. L. HOLT[1]

Read at Cleveland 1936 Convention

SEVERAL different aqueous plating baths for tungsten have been reported during the past few years. In 1931 Fink and Jones[2] suggested two alkaline tungsten plating baths: bath No. 1 was made up with 70 grams of sodium hydroxide, 30 grams of yellow tungstic oxide (WO_3), and 60 grams of dextrose per liter; bath No. 2 was made up with 330 grams of sodium carbonate and 125 grams of tungstic oxide per liter. Metal deposits were obtained from these baths when they were maintained at temperatures of about 90° C. The carbonate bath was deemed the most satisfactory and yielded metal deposits with current densities of from 5 to 26 amps/sq. dm, but the best yields of metal were secured with 8 to 11 amps/sq. dm current.

In 1932 Yntema[3] reported that deposits of tungsten were obtained from solutions of tungstic acid (H_2WO_4) dissolved in potassium hydroxide with this solution made acid by addition of citric acid. He also suggested that sodium hydroxide and tartaric acid could be used and that tungsten was obtained from solutions containing acetic acid and glycerol or glucose. No mention was made of conditions of electrolysis or amounts of metal deposited. In 1933 Holt and Kahlenberg[4] reported that tungsten was obtained by electrolysis of a hot solution made up with 100 grams tungstic acid and 500 grams sodium phosphate ($Na_3PO_4 \cdot 12H_2O$) per liter. A current density of 10 amps/sq. dm. yielded a nice metal deposit from this bath in twenty minutes. It should be noted that with these hot alkaline plating baths the authors reported that they were able to obtain only very thin metal deposits and that the baths were quickly "worn out." Macchia[5] reviewed methods of tungsten plating and concluded that the carbonate and phosphate baths were the best but not commercially feasible.

1. Instructor in Chemistry, University of Wisconsin, Madison.
2. Fink, C. G. and Jones, F. L., Trans. Electrochem. Soc., **59**, 461 (1931).
3. Yntema, L. F., J. Am. Chem. Soc., **54**, 3775 (1932).
4. Holt, M. L. and Kahlenberg, L., Metal Industry, **31**, 94 (1933).
5. O. Macchia, Industria Meccanica, **15**, 475 (1933); C. A. **28**, 7170 (1934).

Three patents on tungsten plating from aqueous alkaline baths were issued to C. G. Fink[6] in November 1932. The first patent describes the sodium hydroxide-dextrose bath, the second the carbonate bath and the third the carbonate bath with added metal cathode depolarizers, the best of which is nickel, introduced into the bath by means of circulation through a bed of nickel carbonate ($NiCO_3$). It is claimed that this bath as described was "adapted for use in producing a substantially pure tungsten plate of any desired thickness...". The nickel carbonate was assumed to be much less soluble in the alkaline plating bath than in water and thus, if this assumption is correct, there could be very little nickel in the bath and thus only a trace of nickel in the deposited metal. Quoting from the patent:[7] (1) "it is probable that the net solubility of nickel carbonate in a sodium carbonate or sodium hydroxide plating bath —, will very likely not exceed one-tenth of that above given in pure water, or about .01 gram per liter or less" and (2) that "the percentage of nickel in the plated layer is then extremely minute, amounting to little more than one thousandth of one per cent (.001%) by weight and often less than this."

In 1934 the present author reported[8] that the metal deposits which he obtained from the above described carbonate, citric acid and phosphate plating baths were deposits of tungsten and iron rather than of tungsten only. It was found that a bath was soon "depleted" — no longer yielded a metal deposit when used — because of removal of the iron impurities from the bath as an electrodeposited tungsten-iron alloy. A bath which was made from pure materials (free of iron impurities) yielded no cathode metal deposit when used. If a small amount of iron was added to a "depleted" bath or to a pure bath it gave on electrolysis a metal deposit of tungsten and iron. The purpose of this paper is to present additional results on carbonate bath depletion and effect of added iron, and also to show that an alkaline carbonate tungsten plating bath with nickel added as a cathode depolarizer yields a deposit of tungsten-nickel alloy and not substantially pure tungsten.

6. U. S. Patents No. 1,885,700; 1,885,701 and 1,885,702.
7. U. S. Patent No. 1,885,702, page 2, lines 2-8 and 53-56.
8. Holt, M. L., Trans. Electrochem. Soc., **66**, 453 (1934).

PLATING PROCEDURE

The electroplating procedure was essentially the same as that previously described.[8] Ordinary pyrex beakers (100 cc. size) placed on a hot plate to maintain a bath temperature of at least 90° C. served as the plating cells. Usually two cells connected in series were used together. Each cell was supplied with two 3 cm. x 3 cm. platinum anodes and a detachable cathode of the same size. The electrodes were provided with platinum leads and supported on an arrangement of 1/8 inch brass rod bus-bars. When in use the cells were covered with notched half-circle glass plates to prevent excessive losses by spattering and evaporation. Water was added to the baths from time to time to keep the volume (about 90 cc.) fairly constant. Only the carbonate type of bath was used in this work for it was found to be the best of the suggested baths. After a plating run the cathodes were quickly removed from the bath and washed. Current was supplied by a 110 volt D. C. generator and regulated by a lamp bank.

Since all the work herein reported is quantitative and required analyses of the metal deposits, only C. P. electrolytic copper foil cathodes were used. They were always carefully cleaned and dried before use. The difference in weight of the cathode before and after electrolysis gave the weight of the metal deposit. Usual methods of analysis for iron, tungsten and nickel were followed. The copper did not interfere in the tungsten and iron determinations but was removed by H_2S in an acid solution before making the nickel determinations.

THE CARBONATE PLATING BATH AND IRON

In preliminary work it was found that the source of the tungstic acid used in preparing a carbonate bath determined the amount of the cathode deposit obtained from a given period of electrolysis. These baths were made by dissolving the sodium carbonate (Merck's anhydrous reagent quality) in the required volume of water and filtering before addition of the tungstic acid — a concentration of 330 grams of sodium carbonate and 125 grams of tungstic acid per liter was always used. With the kind of tungstic acid as the only variable, some baths gave good deposits while others gave only poor bluish deposits. In a series of 1/2 hour plating runs at 20 amps./sq. dm. using carbonate baths prepared

from different brands of tungstic acid, the deposits on the usual 3 cm. x 3 cm. copper foil cathodes varied as shown in Table I.

Table I. Cathode Deposits from Carbonate Baths (20 amps/sq. dm. for 1/2 hour)

Brand of Tungstic acid	*Weight of deposit*	*Appearance of the deposit*
"A"	.0043 gram	shiny metal
"B"	.0029 gram	shiny metal
"C"	.0026 gram	shiny metal
"D"	.0014 gram	metal-bluish
"E"	.0011 gram	metal-bluish
"F"	.0003 gram	no metal sl. blue

Analysis of these various brands of tungstic acid showed that all contained iron but in different amounts. Brand "A" contained an estimated .008% iron while brand "F" contained about .0005% iron. Brands "A" to "E" inclusive were obtained on the market while brand "F" was purified in this laboratory. There was a fair correlation between the iron present in the tungstic acid used in preparing the bath and the weight of the cathode deposit obtained from that bath — the greater iron content of the tungstic acid the greater was the cathode gain per period of electrolysis. Cathode deposits large enough for analysis (.0090 to .0157 gram) were obtained by using several baths and several anodes. The iron content ranged from 22% to 15% and seemed to depend in general on the iron content of the tungstic acid in the bath. Deposits obtained at a lower current density (5 amps/sq. dm.) contained as much as 35% iron. Blank runs on the copper used for cathode material failed to yield a precipitate of iron hydroxide.

Continued use of a bath quickly resulted in a "depletion" of the bath. The weight of the cathode deposit decreased with each plating run until with the 4th or 5th successive run no weighable or visible deposit was obtained — the bath was depleted, for something necessary to deposition had been removed from it. Carbonate plating baths prepared from three different brands of tungstic acid were depleted by a series of successive half-hour plating runs using new copper cathodes for each run. With a lower current density (5 amps/sq. dm.) eight to ten successive runs were necessary to deplete a bath made from brand "B" tungstic acid.

That these baths were depleted because of the removal of the iron impurities was demonstrated in two ways: (1) negative tests for iron in the depleted baths and (2) a renewal of the baths by addition of very small amounts of iron.

In testing for iron a depleted carbonate bath (about 90 cc.) was diluted with an equal volume of water and saturated with hydrogen sulfide. There was absolutely no precipitate of FeS even on several days standing. To check on the method a second depleted bath was diluted the same way and then .00005 gram iron (as chloride) added before saturation with hydrogen sulfide gas. In this case there was a very noticeable precipitate of FeS in two days. Both solutions were tinged yellow but only the one with added iron yielded FeS, a black precipitate which was very readily recognized when allowed to settle. Thus certainly there was no appreciable amount of iron in the depleted bath.

In renewal of the depleted baths various amounts of iron (as chloride) were added to a number of depleted carbonate baths and the different cathode grains for half-hour runs at 20 amps/sq. dm. determined. These results are shown in Table II.

Table II. Renewal of Depleted Carbonate Baths with Iron (20 amps/sq. dm. for 1/2 hour)

Amount of iron added	*Cathode gain*	*Added Fe gain*	*Appearance of*
.0000 gram	.0001 gram		
.0001 gram	.0006 gram	16.6%	Blue-streaked
.0002 gram	.0011 gram	18.2%	Metal—sl. blue
.0005 gram	.0023 gram	21.7%	Metal
.0010 gram	.0043 gram	23.2%	Metal
.0020 gram	.0070 gram	28.6%	Metal sl. tarnish
.0030 gram	.0104 gram	28.8%	Metal sl. tarnish
.0050 gram	.0147 gram	34.0%	Tarnished metal

Attempts to increase the weight of the deposited metal by cumulative deposition on the same cathode gave only fair results, as the amount of cathode gain decreased somewhat with each successful run and iron addition. However, by using several baths and several cathodes, samples large enough for analysis were obtained. The analyses showed that the iron present in these deposits varied from 21% for the .0001 gm. added iron to 29.4% for the .0050 gm. added iron.

EFFECT OF ADDED NICKEL

Preliminary work with added nickel and the carbonate plating bath brought out two facts: (1) nickel carbonate is much more soluble in the plating bath than in water or sodium carbonate solution and (2) a considerable amount of nickel is present in a cathode deposit obtained from a bath containing nickel depolarizer.

The solubility of $NiCO_3$ was determined in the following manner: Separate 2 gram samples of $NiCO_3$—previously washed and dried to remove soluble salts — were boiled for 5 minutes in the solvent used and then filtered at once. Nickel was determined by the dimethyl glyoxime method. Where tungsten was present in the solution it was precipitated as H_2WO_4 by a short period of digestion with $HCl + HNO_3$ and removed by filtration. No doubt some nickel was thus lost but comparable results are certainly obtained. The solubilities at about the boiling point of the solutions used are shown in Table III.

Table III. Solubility of Nickel Carbonate

Solvent Used	*Solubility at B. P. grams/liter*
Water	.056 gram*
Sat. Na_2CO_3	.070 gram*
Carbonate bath	3.382 gram*

*Solubility of $NiCO_3$ in water at 25° C. is .093 gram per liter.

The method of obtaining these results (Table III) was perhaps rather arbitrary, but certainly there is no doubt but that nickel carbonate is much more soluble in the carbonate plating bath than in water or in sodium carbonate solution; instead of being 1/10 as soluble it is perhaps about 40 times more soluble in the hot plating bath than in hot water. The dissolved nickel gave the alkaline bath a decided green color. Ordinarily metals such as iron and nickel precipitate as the hydroxide from an alkaline solution, but the presence of sodium tungstate prevents this precipitation due, no doubt, to the formation of complex compounds.

The solubility of metallic nickel in the plating bath was found to be very slight. When 10 grams of nickel pieces (about 3 mm x 2 mm x 1 mm) were boiled with the carbonate bath for a short

time and then filtered, the resulting solution after removal of the tungsten as tungstic acid failed to give a test for nickel with dimethyl-glyoxime. The small amount of nickel dissolved in the bath apparently remained with the precipitated tungstic acid for when dimethyl-glyoxime reagent was added directly to the diluted alkaline bath previously heated with nickel, there was a fair positive test for dissolved nickel.

Carbonate plating baths with nickel introduced by filtration of the hot bath through a bed of $NiCO_3$ or by boiling with $NiCO_3$ for a minute and filtering, always contained an excess of dissolved nickel as evidenced by the green color of the solution. When used at a current density of 5 amps/sq. dm. a nice metal deposit was obtained in a short time. Thick deposits obtained by cumulative deposition on the same cathode showed a tendency to peel off the base metal. Analyses of ten cathode deposits obtained from carbonate baths containing an excess of nickel, introduced as mentioned above, gave an average composition of 36.4% tungsten and 61.6% nickel. The weight of the deposits analyzed ranged from .0310 grams to .2304 gram. The composition of this deposited alloy approaches the composition of the nickel-tungsten alloy prepared by Fink and Jones[2] by use of a nickel anode in a sodium hydroxide dextrose and sodium tungstate plating bath. Further it has about the same composition as the electrodeposited 65% nickel and 35% tungsten alloy which is apparently now available on the market.

The anode reaction in these excess nickel baths is of some interest. The platinum anodes used in the baths were always quickly coated with a black oxide layer. If the bath was used for a long period of electrolysis, say one hour, without renewal of the nickel content, the green color of the bath disappeared but there was instead an excess of the black oxide suspended in the solution. This black oxide was presumably Ni_2O_3 for on treatment with dilute hydrochloric acid there was a very noticeable liberation of chlorine.

In seeking to limit the amount of nickel present in the bath and thus the amount which would be present in the deposited metal, small amounts of nickel were added to depleted baths or baths prepared from pure materials. Thus, as each amount of nickel (as chloride, iron free) was added to a separate depleted car-

bonate bath the resulting cathode gain for the 1/2 hour plating run at 20 amps/sq. dm. was determined. New copper cathodes (3 cm x 3 cm) were used for each run of the series. The results are indicated in Table IV.

Table IV. Renewal of Depleted Baths with Nickel (20 amps/sq. dm. for 1/2 hour)

Grams of Nickel added	*Cathode gain*	*Added Ni gain*	*Appearance of plated cathode*
.0000 gram	.0001 gram		
.0001 "	.0003 "	33.3%	No metal-sl. blue
.0002 "	.0005 "	40.0%	Sl. metal-blue
.0005 "	.0009 "	55.5%	Metal-blue
.0008 "	.0011 "	72.7%	Metal-blue
.0010 "	.0015 "	66.6%	Shiny metal
.0020 "	.0026 "	77.0%	" "
.0030 "	.0035 "	85.7%	" "
.0050 "	.0052 "	96.1%	" "

Since a nickel determination by the glyoxime method is quite accurate even for small samples, the amounts of nickel in the deposits (Table IV) were quite easily determined. The deposit from the .0002 gram added nickel contained an estimated 40% nickel and all the others contained 50% or more nickel. Due allowance was made for the .086% nickel content of the copper foil cathodes used. There was no black anode coating in the .0001 to .0008 gram added nickel plating runs but in all other cases there was an anode oxide formation, the amount of which increased with an increased amount of added nickel.

Carbonate plating baths with nickel introduced by means of nickel metal or by nickel oxide failed to yield cathode deposits free of nickel. Two separate carbonate plating baths of pure materials were used once to remove last traces of iron. Then one bath was boiled for 2 minutes with 10 grams of nickel pieces and filtered at once and the other was boiled the same length of time with about 2 grams of C. P. black nickel oxide and filtered. A half-hour plating run at 20 amps/sq. dm. yielded in each case a deposit weighing .0008 gram, metallic in appearance but tinged blue. Analysis showed that each deposit contained at least 40% nickel.

COMPARISON OF IRON AND NICKEL EFFECTS

Results with added nickel and added iron should be comparable since they were obtained by similar methods. They are

presented graphically in Fig. II.* As can be seen from Figure II, iron is much more efficient in renewing the carbonate plating bath than is nickel. Thus the metal plated from a bath with added iron has a higher tungsten content than that plated from a bath with added nickel.

Not all the metal (iron or nickel) added to a bath to renew it was removed by a single half-hour plating run, particularly where larger amounts were added. However, a number of successive runs depleted the bath again because of complete removal of the added metal.

So long as the renewed bath yielded a cathode deposit it contained some of the added metal, but when finally depleted it was entirely free of the metal. Baths could be successively depleted and renewed but because of concentration changes, pH changes and perhaps the effect of added chlorides, the size of the cathode gains decreased with each run and the resulting plates were quite dull and streaked in appearance.

DISCUSSION

On the basis of the results herein reported it seems reasonable to conclude that none of the proposed aqueous tungsten plating baths, when used at the described conditions, yields a deposit of pure or even substantially pure tungsten. That a method of tungsten deposition such as that mentioned in Creighton and Koehler "Electrochemistry"[9] yields a metal cathode deposit is explainable when one considers the always present iron impurities of tungstic oxide and of ordinary sodium carbonate. The bath gives a small amount of deposit and then deteriorates or "wears out" because the iron originally present in the bath has been removed as an electrodeposited tungsten-iron alloy. That a bath prepared in exactly the same way but of pure materials and used at exactly the same conditions yields no deposit is also explainable — no iron is present in the bath and therefore there is no cathode deposit. The fact that the addition of small amounts of iron to the depleted bath or to the pure bath serves to renew the bath is just so much more proof of the importance of iron to metal deposition from the bath. The iron content of these electrodeposited tungsten iron alloys was found to vary from 15% to 35%

9 Creighton and Koehler, Electrochemistry Vol. II (1935) page 145, John Wiley & Sons.

depending on current density and amount of iron present in the bath.

It is readily understandable that another metal such as nickel will act in much the same manner as iron to renew a carbonate plating bath. When nickel is present in the bath a cathode plate is secured from that bath but nickel is present in the deposited metal. When nickel is removed from the bath as nickel-tungsten alloy the bath is no longer able to give a metal deposit.

On the other hand, these tungsten plating baths, particularly the carbonate bath, seem to offer a possible means of attack toward a successful method of tungsten plating. So far as our theories are concerned, there seems to be no really good reason why it shouldn't be possible to successfully plate tungsten from aqueous solutions. The writer has tried a large number of addition agents in the depleted alkaline bath with no special success but perhaps the right addition to a modified alkaline bath would solve the problem. (Applause)

CHAIRMAN HOGABOOM: We wish to thank Dr. Holt for his very interesting talk. We seem to be exploding theories in this meeting at this time. We very much appreciate being informed upon the tungsten situation. I am quite certain that there are some persons present who would like to ask Dr. Holt some questions.

MR. W. CASTELL: I was especially interested in Dr. Holt's paper because not long ago there was an article in Machine Age telling about the invention of tungsten plating. My boss came across that article and handed it to me and told me to get busy and find out how much tungsten we could deposit. I am very glad to hear that Dr. Holt found that he was not able to obtain heavy deposits of tungsten.

I listened to the argument about tungsten plating in 1934 at the New York meeting of the Electro-Chemical Society. I had worked for about three months on depositing tungsten. We are especially interested in tungsten deposition as we are using quite a lot of tungsten for contact points. The only way I could deposit any tungsten was by adding nickel to the bath. I followed the instructions of Dr. Fink as religiously as possible, and every time we made up a fresh batch we could deposit a very thin film of tungsten and then the bath would quit. Therefore, I want to thank Dr. Holt again and tell him how much I appreciate hearing his talk. (Applause)

CHAIRMAN HOGABOOM: Is there any other discussion?

MR. E. SOHN (Mansville, Kentucky): Last Friday I had a call from the technical men who represented this outfit in Washington who were attempting to plate and who do plate a nickel tungsten coating. As you have seen from these experiments and these results, the thing that happens is that you deplete the coating of nickel. As nearly as I can get it, these fellows are using an anodic means of maintaining their nickel content, and also, so far as I could gather, they are using an anode which consists of nickel and tungsten carbide, and by virtue of this anode, the nickel replenishes itself. Whether they use the alkaline type of solution, I cannot tell you, but apparently, from the results indicated here, it would be rather a fair assumption to take it that they were using an alkaline solution. In so far as the application of this particular alloy is concerned, there would be much ground for discussion. However, again as I gather it, the possibilities are that because of the acid resistance of the nickel tungsten alloy, there might possibly be some applications wherein you want a persistence of nitric acid for what-not.

The other point brought out was that on the assumption that the cost of nickel deposited would be about fifty cents a pound, as the cost of the metal, that this alloy would cost in the neighborhood of eighty-five cents a pound, and, of course, we did some experimenting with it. When we got through with it we concluded that in so far as using this alloy as against this grade nickel in the case of a deposition over brass followed by a small coating of chromium was concerned, if you want to call it that, there was no virtue to it. But, to repeat, there is the possibility that this coating of itself might have some special applications.

CHAIRMAN HOGABOOM: Is there any further discussion?

MR. J. H. HOEFER (Detroit, Michigan): I would like to ask Mr. Holt what cathode efficiencies he obtained.

DR. HOLT: The cathode efficiencies were much less than one per cent. In cases where there was no added metal, merely the impurities from the iron in the bath, I would say the cathode current efficiency was in the neighborhood of, perhaps, one one-hundredth of a per cent.

CHAIRMAN HOGABOOM: Dr. Holt, I wonder if you could tell us something about the anode used. Another thing that Mr. Sohn

brought up was the solubility of the coating in nitric acid.

DR. HOLT: The anodes that I used for these reported results were in all places platinum. The platinum anodes were not attacked at all. I have also used tungsten anodes, as has previously been suggested in other work, but they did not seem to help the solution at all. It just built up the tungsten content of the bath and the impurity of iron from the tungsten anode rather regenerated the bath, but there was again a deposit which contained iron and tungsten. I did not use a nickel anode. However, Professor Fink, in his first paper on tungsten plating, suggested using a nickel anode in the alkaline carbonate bath and the result was a deposit which contained approximately fifty per cent of nickel and fifty per cent of tungsten, as he reported those results.

The very thin deposits obtained from these aqueous alkaline carbonate baths had very little resistance to corrosion. In my analyses I simply dissolved the base metal in nitric acid, not very strong nitric acid, so you can see there was very little protection of the base metal. In all cases when I wanted to make an analysis of the sample, I simply subjected the cathode deposit along with the proper cathode in nitro-hydrochloric acid, of course oxidizing the tungsten present to tungstic acid.

MR. WALTER MEYER: Mr. Holt's presentation of the effect of iron and nickel, I think, presents a fundamental problem that I wish could be answered, and that is why tungsten electrodeposits out in the presence of iron and nickel and will not deposit out when those substances are not present. I believe nickel will not deposit from a cyanide solution, but if you add copper to the solution you can deposit alloys of copper and nickel. It is a fundamental problem, and if we could answer it, I think we could put the answer to some practical use.

DR. WERNICK'S VISIT TO THE UNITED STATES

Dr. S. Wernick, Honorable Secretary of the Electrodepositors' Technical Society expects to reach New York about April 19 to make a general survey of developments in the Metal Finishing Industry in this country. The English Society which Dr. Wernick represents is very similar to our own A.E.S.

We take this opportunity of extending the greetings of the organization to our distinguished visitor, hoping he may have a pleasant and profitable visit.

We feel confident he will carry away with him not only items of general interest, but pleasant memories of those with whom he becomes associated.

To the Ladies

The Easter season and the lovely days of spring do something to us. We become aware of the quickened tempo of life. There takes place within us a recharging of the spirit, a restless stir in our blood, an urge for the romantic.

We of the Convention Committee are not unlike the young man whose fancy in the Spring lightly turns to thoughts of sweet dalliance with the lady of his heart under the chaperonage of Cupid.

You've guessed it, fellow members of the A.E.S., we refer to the ladies. Those dear, lovely companions of our joys and sorrows, who will accompany us to the Convention in June, and for whom we are planning one grand time.

Believe us, in this, New York City offers the opportunity. We are actually troubled with an excess of riches. Our problem is not what to include in the programme, but what we can crowd into four days from the great variety offered.

First and foremost there is planned their ease and comfort, against a background of friendly association. Upon registering each lady will receive a beautiful gift. Then there are the banquets, floor shows, bus rides to the high points of interest in the city, tours through Radio City, visit and inspection of a great ocean liner, shopping tours, theatre party, bridge party, luncheon at a famous Night Club, a visit to the Hayden Planetarium; as much of these as time and inclination of the visitors will allow.

In order that no detail may be overlooked and to insure four full days of pleasure, the following committee of charming and enthusiastic ladies have been placed in charge of the ladies programme.

MRS. LOUIS H. CATES, *Chairman*

MRS. FRANKLYN J. MACSTOKER	MRS. BENJ. POPPER
MRS. PHIL MORNINGSTAR	MRS. JOAN WAGNER
MRS. JOHN STERLING	MISS JOAN TROMBOUR

Finally, to you fellow members, just a word to the wise. The home is the dearest place in the world, but an interlude away from it, revitalizes interest in it. Ask the ladies.

Bring the wife with you to the Convention in June. New York, and the planned programme, present all the elements that permit a rededication to the sentimental attentions so dear to the hearts of the ladies. They will love it. We will be happy to have them.

THE CONVENTION COMMITTEE

LOUIS H. CATES

Publicity Chairman

Greetings of the Founder of the A.E.S. to the Officers and Members of the Los Angeles Branch

Greetings from Clearwater, Florida, to California and the splendid City of Los Angeles, which gives me, as the founder of your Society, a great deal of pleasure to send to you through my dear friend, Mr. Ernest Lamoureux, these expressions of good will, and the hope and anticipation of a splendid success that should result from your united efforts in bringing to the entire Electro-plating fraternity the first West Coast Convention.

I personally feel that your united efforts will bring to every Plater on the Pacific coast the value that will result to them in being a member of our Society, which stands today as one of the foremost educational societies in the country, built upon a solid and lasting foundation by men of practice in the art of Electro-Plating, and also as a monument in the great metal fabricating industry of the world.

The earnest desire of the founder was to enable the practical plater, through the Society's efforts, to bring about a greater knowledge of the Art through a study of the chemistry of electro-plating, that should enable every member to understand the fundamentals, and, through a study of the underlying principles of chemistry and electricity, to become a more scientific as well as a more valuable practical plater, with a greater knowledge, and fulfilling the motto of the Society, that "Knowledge is Power", which enables the American and the Canadian electro-plater to become a greater asset to himself, to his employer, to the great industry of which he is a part, as a member of the Electro-Platers Society, and to our great country.

It comes through the mist of years that aptly applies to this wonderful country, the words of the Great Creator of all things when he destined America to be the home of the peoples of the ages: "Lo! I uncover the land as I did of old in the west as a sculptor uncovers his statue when he has wrought his best".

But we must realize, as Patrick Henry, the sage of our American Revolution, did, when he uttered that immortal statement, "There is only one lamp to guide my feet and that is the Lamp of

Experience", which, as we journey along, with all the knowledge we can acquire in our adopted profession, is our greatest teacher.

In looking over your program of Educational Session, it appears to me that you have a splendid one, which will be thoroughly enjoyed by every one.

"Cleaning Before Plating" should be an excellent paper. Producing a chemically clean metal surface is essential, and the true basis upon which the electro-deposited metal structure must adhere and endure. So I trust this paper of Mr. F. A. Maurer will greatly benefit the hearers. In 1918 I had the pleasure of visiting the plant of the General Electric Company in Ontario California.

"Plating of Unusual Metals" will no doubt prove an interesting subject, by Dr. S. Fisher, Electro-chemical Engineer. I most sincerely wish it were possible for me to be present to listen to Dr. Fisher's paper.

"Pertinent Plating Topics", by Mr. Oliver J. Sizelove, should be entertaining and interesting, with his chemical and practical knowledge. My sincere wishes are that this may be so.

The "Pictorial Study of Plating Conditions", by Mr. W. M. Phillips, Research engineer of General Motors of Detroit, will, I am sure, be of wonderful interest.

As I journey backward through memory, and follow step by step the progress of Electro-Plating since I first saw the light of a nickel-plating solution in England, in 1880, I realize the wonderful advances made in the art, and my connection with the industry as an integral unit.

I have several times read the paper of one of the distinguished members of the Society, "What is Under the Plate", and have come to a definite conclusion that irrespective of the basic metal upon which the electro-deposit is to be applied, and of the most careful attention paid to the cleaning of the basic metal, without the faintest trace of oxidation of its surface, that could prevent a true union of the deposit with the base, our greatest problem is hydrogen control. I have more than once termed hydrogen as the "devil of the electro-plating solution". It is the cause of non-adherence, when, as a mist, it lies upon the metal surface to be plated, it takes away the ductility of the deposited metal; it creates the problem of pitting, thereby resulting in a porous structure,

which here on the Gulf has been found to be the greatest problem the rusting of the chromium nickel plated steel surfaces as applied today. This is principally due to the highly sodium chloride-laden atmosphere of the Gulf. Every automobile that is here for a definite period shows the same result.

My conclusions then are that a still greater study should be made on the detrimental effects of "Hydrogen", and its influence upon a basic ferrous metal surface to which electro deposits are applied.

Thus I conclude this message to you upon this auspicious occasion. May this Convention prove to be a wonderful success and a greater milestone forward in the history of Electro-plating.

I have visited Los Angeles at least four times since my first visit in 1918, and it is with the sincerest wish that upon my next visit I may have the pleasure of meeting with the Los Angeles Branch, and re-enjoy the friendships made through the years.

Very sincerely, CHARLES H. PROCTOR
Twin Palms, Clearwater, Florida

EDUCATIONAL SESSION AND DINNER DANCE HELD SATURDAY, MARCH 20, 1937

When I make the statement that this event far exceeded the expectations of the Branch and the Committee in charge I am really conservative about the matter. The attendance at the Educational Session in the afternoon was not only better than was expected, but it represented a gathering of most plants in Southern California with some representation from San Francisco and the Northern part of the West Coast and all of them were keenly interested in the proceedings, because they not only heard but saw presented before them many features of the science of plating entirely new to them. The lecture by Mr. W. M. Phillips, Research Engineer for the General Motors Corporation together with the slide illustrations was the high light of the meeting, with the subject presented by Mr. F. A. Maurer Electro Chemical Engineer of the Hotpoint Division of the General Electric Co., of Ontario, California, a close second and Dr. S. Fisher's presentation of the Plating of Unusual Metals was a revelation in many ways, and Mr. Oliver J. Sizelove presented "Pertinent Plating Topics" from a practical angle for those less versed on the technical side of plating, but all of whom profited from the entire Program.

Our friend Sulphur McKeon who arrived on the scene as early as March 14th, stayed over for the affair — was called upon before the close of the afternoon meeting and acquitted himself in his usual good style, and planted the seeds for the 1939 A.E.S. Convention.

We would be remiss in our duty if we did not express our gratitude to L'Hommedieu & Sons Co., Turko Products Co., Price-Pfiester Co., Repcal Brass Mfg. Co., General Spring & Bumper Co., Hotpoint Division of the General Electric Co., Ontario, California, Los Angeles Chemical Co., Braun Chemical Co., Meford Chemical Co., The J. B. Ford Co. and others too numerous to mention for their co-operation and help in making the whole affair the wonderful success it really was, as well as its value to the A.E.S. as a whole, and the West Coast Plating Industry in particular.

Cleaning *Before* Plating

By F. A. MAURER
Eng. Dept. General Electric Co.
Ontario, Calif.

Read at Los Angeles Annual Meeting
March, 1937

THE cleaning of metal for any purpose whatsoever is an exacting physico-chemical process. When metal must be cleaned prior to electroplating, it becomes doubly exacting. Whereas for many purposes an approximately clean surface on the metal is sufficient for good results, for electroplating the surface must be chemically clean or "bare metal clean." This means that for an adherent plate — one which will stick to the basis metal "thru thick and thin" — under all conditions of exposure and temperature changes — all manner of substances foreign to the chemical composition of the basis metal and not integral with it must be removed.

CLASSIFICATION OF FILMS

Such substances, according to Mr. C. Johnson* of Oakite Products, include the following — in the form of very thin films:

Mr. Johnson has divided the films into water-repellant and water-wettable, and a further subdivision of these films of foreign substance is made into visible and invisible films.

WATER REPELLANT FILMS	WATER WETTABLE FILMS
	Visible
Mineral Oil and fats	Scale or Oxides of the metal (relatively heavy coatings)
Animal Oil and fats	
Vegetable Oil and fats	
Soaps — Soap substitutes	Other Chemical combinations of the metal
Fatty Acids	
Finely divided solid matter — dust, carbon smut, etc.	Films of small particles "plated out" in cleaning
	Invisible
Gas absorbed on the metal	"Passive" Surface oxidation
	Metallic Silicate films formed by cleaner compound on brass
	Chromate films due to cleaner contamination

*Films and their relation to cleaning before electroplating—By C. Johnson—Proceedings of A.E.S., 1936.

Before going further we should define the meaning of "film." We do not mean only the thick film of oil which coats cold rolled steel, for protection against rust. This film is tremendously thick in comparison with the films which we have in mind. These films are of the order of magnitude of the wave-length of light. A water repellant film of mineral oil, for example, may well be only one molecule in thickness — estimated at (one-quarter of one millionth of an inch). An invisible oxide film on a metal (resulting in a "passive" surface) is estimated to be less than 1.6 millionths of an inch.

An intensive study of these films of molecular dimensions, and their relation to electroplating, has been going on recently, and in a correlated abstract, Mr. W. R. Meyer* of General Electric Company has made a general classification of surface films.

1. *Preferential solution films*
   (Formation of carbon smut on cold rolled steel by pickling — removed by anodic treatment in Conc. H_2SO_4). (Copper and Silicon in Aluminum Alloys, Aluminum dissolved by strong alkali leaving copper and silicon. Copper in Zinc base alloys, Lead in Brass, Antimony in Lead — left as films) Film can be removed by suitable acid treatment.
2. *Deposited films* (such as absorbed colloids, metallic smuts — may be tin, lead, zinc, iron or copper — "plated on" in cleaning, metallic films formed by differences in electrolytic solution pressure such as plating on of copper when steel is merely immersed in copper sulphate.
3. *"Passive" films*
   (Thickness not over a few millionths of an inch well known as passive nickel and chromium) Generally these are oxide films. They affect adhesion adversely also they affect throwing power of solutions.
4. *Polishing films (or buffing)*
   (Deformation of metal structure occurs resulting in a non-crystalline or amorphous structure — caused by fine polishing).

Meyer considered the effect of grease and dirt films as too well known to require comment. He showed that the structure of the films was influenced by the structure of the basis metal.

*W. R. Meyer, "The Role of Films in the Electro-deposition of Metals", Metals and Alloys —May and June, 1936.

When polishing films, passive films and others are removed and the crystalline structure of the basis metal is exposed, this crystalline structure is extended into the electroplated metal. Maximum adhesion of the plated coating occurs when there is this extension of the crystal structure.

A study of the various films is of interest in itself, as adding to our fund of general knowledge. More especially, as practical platers, are you gentlemen interested in the methods and materials available for removing these films and "getting down to brass — or iron or steel tacks!" The newer developments in plating such as deposition of bright plates, which do not require buffing, mean that the basis metal must be "film free" both on account of the good adhesion demanded, and on account of the need for freedom from a cloudy appearance under the plate.

METHODS FOR METAL CLEANING

According to Dr. R. W. Mitchell* of Magnus Chemical Company, metal cleaning is accomplished by one or more of five general methods of handling.

1. In still tanks, employing alkaline solutions for removal of oil or grease and acid for rust and scale removal.
2. In electrolytic tanks, using alkaline and acid electrolyte for same purpose as above.
3. In a washing machine where parts are mechanically handled thru an alkaline solution.
4. By steam gun or vapor cleaning, using alkaline solutions.
5. By solvent cleaning.
    a. Using organic solvents in either or both the vapor and liquid state.
    b. Using organic solvent emulsions.

Number 4 is very seldom applicable to cleaning before plating.

APPLICATION OF THE METHODS TO CLEANING BEFORE PLATING

Still tank cleaning, in which work to be cleaned is dipped a short time, or preferably soaked, in a water solution of an alkaline cleaning compound is probably the most widely used method for removing oils and fats and paints from the surface. Where the volume of work is not too great, so that the time and labor element do not become a large factor, the still tank is to be recommended on account of its ease of handling and cheapness.

*R. W. Mitchell "The Metal Cleaning Handbook", Magnus Chemical Company.

A still tank should with but few exceptions be operated at or near the boiling point. There is a simple axiom in Chemistry that the speed of a chemical action doubles for each rise in temperature of 10° on the Centigrade scale. Thus at higher temperatures solutions have greater penetrating power, oils and fats are softened and more easily acted upon, and the chemicals of the cleaning compound become more active.

The compound to be used will obviously be governed by the nature of the article to be cleaned. Soft metals such as zinc and aluminum and their alloys are rapidly dissolved by compounds whose "active alkalinity" is above pH 10. Tin is etched at pH 11 or above. Iron and steel, if not too heavily alloyed with silicon will not be affected by even the strongest alkalis.

The cleaning solution must have high penetrative and "wetting power" for solid particle dirt. It must have the ability to keep dirt in suspension, and to emulsify oils and fats. It must have power to saponify fatty acids. In general these effects are best achieved by combining a small percentage of soap with chemicals of not excessively high alkalinity.

The blending of the various alkaline substances available into a cleaning compound and the specification of a correct compound out of many available for a particular job is not a task to be considered lightly. Many men have devoted the best years of their life to perfecting cleaning technique.

It is perfectly true that a single chemical, or simple mixtures of chemicals will often serve very satisfactorily on a particular operation. We do not however consider it advisable for each plater to be his own cleaner formulator, as the making up of cleaners should be done by one who understands the action and the effect of each component of the cleaner.

Still tanks when used with alkaline solutions are almost invariably of steel. When used with acids as a pickle for removing heavy scale, or a dip after grease removal to neutralize alkali and remove any light oxide film, they may be of steel either lead lined or hard-rubber lined. The acid is usually 50% Hydrochloric or Sulphuric.

ELECTROLYTIC TANKS

An electrolytic cleaner tank is one in which direct current is passed between the work and either the tank itself, or a set of electrodes. The more common practice when alkaline solutions

are kept in a steel tank is to use the tank as either anode or cathode.

An electrolytic cleaner operates faster than a still tank, probably because of the lifting and prying action on the solid particle dirt and oil film of the multitude of gas bubbles released.

A great many of the principles applicable to still tanks hold for electrolytic tanks. The speed of action is increased by increasing the temperature. The solution must have penetrative, wetting, suspensive, and emulsifying properties, as for a still cleaner. In addition it should have good conductivity. The content of soap should be very low, else excessive foaming results from the large quantity of gas released at anode and cathode. The foam may trap hydrogen and oxygen gases in correct proportion to cause an explosion. Large amounts of free caustic potash or caustic soda should be avoided, unless very adequate ventilation is provided as the spray from gassing of the solution will carry the caustic into the working quarters, to deposit on the skin of operators and cause a severe irritation.

Either anodic or cathodic cleaning may be employed on steel. On polished cast iron, we have found it best to employ anodic cleaning. Fine particles of iron, carbon, iron carbide and grease are thereby "plated off" the surface, which is left perfectly clean, yet not tarnished. On softer metals such as brass, zinc and aluminum alloys it will generally be preferable to clean cathodically as the dissolving effect of the solution is nullified.

A special case of electric cleaner is the cyanide copper flash, or cyanide zinc flash. The solution is generally a mild plater's cleaner at about 8 oz./gallon, or the equivalent thereof in simple chemicals, with 1-2 oz./gallon copper cyanide or zinc cyanide and about double this of Sodium cyanide. Copper or zinc anodes are used.

We have found the cyanide copper cleaner an invaluable aid in securing an adherent nickel deposit. The service required of our plate is unusually severe, as electric irons are heated rapidly, and subjected to alternate heating and cooling thru their life.

In electrolytic pickling tanks, rust and scale are removed from iron and steel with less damage to the basis metal than in still pickling tanks. The metal is less active chemically when made cathode, and therefore not as apt to be pitted and etched. In addition the vigorous hydrogen evolution helps to reduce the

coating of oxide to a lower state, more readily soluble in acid. There are several excellent patented processes which employ high current densities at moderately high temperatures. Rapid removal of scale, no hydrogen embrittlement, no black carbon smut and a minimum of basis metal attack are claimed.

In our operation, work coated with mineral oil, polishing grease, or both, is cleaned anodically, rinsed, acid dipped, rinsed and copper flashed all in a conveyor system. Nickel would not adhere satisfactorily without the copper flash unless the surfaces were scrubbed after cleaning, with an abrasive powder. This is on account of what is probably a film of soap from the cleaner. This film is not rinsed off by clear water, and is probably converted to a film of fatty acids when the soap is broken down by the acid dip. In the cyanide copper bath, the fatty acid is saponified and emulsified, and as a chemically clean surface is exposed, copper is deposited. This copper tends to remain bright and clean, without oxidizing, longer than iron or steel and therefore affords a surer base on which to deposit nickel.

MECHANICAL WASHING MACHINES

Metal washing machines are built in the rotary drum type and the continuous conveyor type. Each has its particular application, and excellent results can be obtained from either type. The relatively weak, hot cleaning solution, which cannot contain soap else excessive foaming results, is forced thru spray nozzles under pressure and strikes the work from all angles. Rinsing of the washed pieces is accomplished in the same machine by powerful jets of clear rinse water. The cleaning compound, which must be completely soluble to avoid stopping up the passages, is used at one to two ounces per gallon. Mechanical washing machines afford an excellent means of reducing cleaning costs and providing more satisfactory working conditions.

SOLVENT DEGREASING MACHINES

Of comparatively recent origin is the large-scale utilization of non-inflammable organic solvents for removal of oils and fats and oily dirt.

Machines are avilable in both manually operated and completely automatic conveyorized types for the efficient handling of parts in process.

Solvent cleaning with solvents of petroleum, coal tar and similar origin was practiced to a limited extent before the introduction of the synthetic chlorinated hydro-carbon solvents. Cleaning consisted generally in simply soaking the oily parts in solvent, draining, and rinsing once or more in cleaner solvent. Parts always had an oily film left on them, even under the best of operating conditions. Solvents were used cold, due to the fire hazard at elevated temperature.

In addition to freedom from fire hazard the new chlorinated solvents have unique advantages which make them ideally suited to cleaning oils and fats, tars and pitches off new work which is subsequently to be enameled or plated. An outstanding advantage is that they are excellent solvents for these substances.

They boil at temperatures below the boiling point of water, and require much less heat input per pound vaporized than does water. The cycle of vaporization and condensation is consequently economical, and may be carried out in steam, gas, or electric heated units. As in alkaline solutions, the cleaning efficiency is much greater at elevated temperatures.

The vapors of these Chlorinated solvents are approximately four times as heavy as air. This very fortunate property makes it possible to design equipment which is exceedingly economical of the use of solvent. So little vapor is lost that, although the vapor is toxic and will produce anesthesia (but no permanent harmful effect), no discomfort is experienced by workmen operating the equipment.

The equipment is designed to produce in one compartment a boiling bath of solvent; in another adjacent chamber a bath of relatively clean condensed vapor; and above these two chambers a space occupied by the solvent vapors. At an appropriate height above the rinse chamber there is a cooling belt, through which cold water circulates. Solvent vapors from the boiling chamber rise in the equipment to the level of the cooling belt. Here, due to their relatively low latent heat they are easily condensed and drain down into the rinse chamber.

The effectiveness of the new solvents is due to their great solvent power, and to their ready condensation on a cold surface. Heavy articles may be suspended in the vapor space above the boiling chamber. Here the hot vapors strike the work and are

immediately condensed. The hot condensed solvent then drains off, carrying with it the oil or fat, wax, pitch or tar. Condensation continues until the article is heated to the temperature of the vapor. By this time, on a heavy article all the soluble matter will have been dissolved, and in addition much of the insoluble dirt will have been flushed off. Articles of light gauge or weight are generally immersed in the boiling chamber then rinsed and cooled in the rinse chamber. Finally the last trace of soluble foreign matter is flushed off by suspending in the vapor space above the boiling chamber.

In the case of work coated with oily dirt, there is some tendency for the dirt to remain on the surface, although all oil will have been removed. The dirt can be almost entirely removed by spraying the surface with solvent under pressure.

In the newer design of automatic machine numerous combinations of liquid, vapor, and spray have been used, and in fact almost any combination desired can be obtained.

Cleaned parts come from a degreasing machine absolutely free of grease, dry, and hot. An adherent electro plate cannot be applied however without an intervening electrolytic alkaline cleaning. The reason for this is obscure, as no film can be detected, according to manufacturers of degreasing machines, who lean to the theory of an electrostatic charge on the surface, or similar electrical phenomenon. A cyanide copper flash is ideal following degreasing. However the surface can be properly prepared to receive an adherent plate by electro-cleaning in a solution containing as little as 1/4 ounce per gallon of compound.

SOLVENT EMULSIONS

For pre-cleaning unusually dirty work, the surface of which may be coated with one or more of the following substances — black smut, drawing lubricant, slushing oil, oily dirt, lubricating oil or polishing and buffing compounds — solvent emulsions may often be used economically.

Solvent emulsions are of three types. The compound may be added directly to water, in which case a milk white emulsion is produced similar to soluble oil emulsion. The compound may be added to kerosene, in which case there results a clear solution of compound in kerosene. Or, the compound may be added to a

mixture of approximately two parts water to one of kerosene. The same compound is not generally applicable to all three types of mixtures.

The work, after dipping for 30 seconds in the emulsion, preferably warmed somewhat, and drained, is finally rinsed in a spray rinse under considerable pressure. Practically everything is removed by the soaking and rinsing except a light oily film, which comes off easily in an alkaline still tank, or electric cleaner.

The action of solvent emulsion cleaning may best be explained when we realize that the compound contains an oil soluble soap. This penetrates the oily dirt on the work and when the water rinse hits it, the soap instantly emulsifies the oil, with which it is in intimate contact, or partially dissolved in. Oily dirt is then easily flushed off with the water rinse.

SUMMARY

The cleaning methods discussed each has an appropriate application for which it is best suited.

For the general run of small shops, probably the alkaline soak tank is best suited. Plating from an acid solution can be applied directly over a surface so cleaned provided the surface is slimed with a mop or scoured with fine abrasive. Plate from an alkaline solution such as copper, zinc or cadmium will probably adhere satisfactorily without sliming, provided rinsing has been very thorough.

A larger job shop or a production plating plant can ill afford to be without an electric cleaner. The time of cleaning is materially reduced and more uniform, more satisfactory results obtained. An adherent plate cannot in all cases be obtained without first sliming or scrubbing the surface. We therefore favor a cyanide copper strike after electro cleaning. When copper is not desired, a second electrolytic cleaner tank, with polarity the reverse of the first, will render a surface suitable to take an adherent plate. Mechanical washing machines have their applications, more especially in production plants than in plating job shops.

Very heavy oily deposits are best removed by first soaking in a still alkaline tank, or running through a degreasing machine, or by solvent emulsion cleaning, followed in any case by electrocleaning in an alkaline solution.

While numerous improvements in cleaning technique as just

described and materials such as soap substitutes stable in acid solutions, sulphated fatty alcohol wetting agents, and materials for making solvent emulsions, have been developed, we still rely for a final preparation of the surface prior to acid dipping and plating on that old reliable stand-by — the alkaline solution.

PICTORIAL STUDY OF PLATING CONDITIONS

MR. PHILLIPS: Now are there any questions about the nickel plating any one wants to ask? If not we will go on to the next solution, which I may say, is one of the most perfect plating solutions we have to deal with. That is, Copper Sulphate Solution. I say it is one of the most perfect from this angle: That the efficiency of it is very high. For instance, I carried it on deposition that over a period of six or seven years on figuring the amount of metal deposited against the current used, we had about 92% and that is almost unobtainable in any other solution, any other common solution I should say.

Explanation of Experiments

MR. PHILLIPS: Don't hesitate to ask questions.

MR. MARIGOLD: Mr. Phillips, may I ask if you added any salt to that copper solution?

MR. PHILLIPS: Well, we have tried that but on the projection you can't see much difference, that is, on the Project-o-Scope, unless you leave it in a long time. The salt somewhat increases the efficiency and it decreases the formation of carbonites. Even a copper cyanide bath with Roshell salt added to it will decrease the carbonites. Back home a firm tried to find out why. What was their success I don't know, but it has been proven by one of our divisions that it is so.

MR. MAURER: Which side is the cathode on in this plate?

MR. PHILLIPS: The outside.

THE CHAIRMAN: What is the Metal of the piston?

MR. PHILLIPS: Cast iron.

THE CHAIRMAN: What about the throwing power of that bath, is the throwing power less noticeable than that of an alkaline bath?

MR. PHILLIPS: Yes.

MR. HURD: Is it possible to plate lead without any preliminary plating at all?

MR. PHILLIPS: Yes, I happened, quite a number of years ago, to have quite a lot of battery terminals and also the bolts and nuts to plate. We deposited a full 32 on some of those without treating them at all.

MR. HURD: How much time did it require?

MR. PHILLIPS: I don't remember exactly, but it takes quite a little while. That is all, gentlemen.

THE CHAIRMAN: Mr. Phillips, I want to thank you a great deal, for that is very interesting to us. Something, perhaps, most of us haven't been able to see before. One other thing perhaps I should mention and that is that Mr. Golden and Mr. McClaren have been very kind to help Mr. Phillips with this demonstration here and we wish to thank them both.

MR. PHILLIPS: I also want to thank them both. They are a very good crew.

THE CHAIRMAN: They did a very good job. I wonder, Mr. Phillips, if you have anything to say in regard to the society you have back East and how it compares with us.

MR. PHILLIPS: I think gentlemen, that out on the Coast, judging by this afternoon, that you have a very wonderful opportunity in the plating field. I have been chairman for some years of the Research Committee, your Research Committee, and that committee is doing a thing that I think is the most important thing in Electro-plating. They are trying to find out for the first time just what kind of plate and how much is needed on various kinds of metals. They are finding out how they work on steel. They are doing work which will revolutionize the plating industry. We have also got to find a non-varying dye. We have started another program to do that. We are about a year along with that; we may have two more years to go yet. We want everybody to help with money. We want it to come from the manufacturers in relatively small amounts. We could get this money by going to a couple of larger manufacturers and asking them, but then they would own the research. I don't want anybody to own the research. I want it to belong to the industry at large. I want everybody to benefit. I would also like to have everybody help. I am going to suggest before I leave to have a committee of you gentlemen call on your manufacturers out here. I will help you all I can. I'll send you all the literature I have and

anything else that will be of help to you. But don't depend on it; I can't write letters that are good enough for the job. You will have to see these people, they won't come into this thing unless you personally go and see them. I just want to promise you it is the best investment anyone can make right now because it is information they have never had. Thank you gentlemen.

Dear Mr. Kennedy:

I wish to report a most successful West Coast convention. The attendance was excellent, and the interest seems to be running high.

They have quite a number of go-getters out here, and our affair on Saturday night was both very instructive and very enjoyable. The educational session in the afternoon was extremely well attended and an even larger crowd was present in the evening for the dinner, floor show and general festivities.

I believe that our Society has an opportunity here for great development in the future. I think all the other branches should give Los Angeles and San Francisco branches their earnest support.

Very truly yours,

W. M. PHILLIPS, *Chairman*
Research Committee

Dear Editor Kennedy:

On my recent swing around the nation, I was spending a few days in Los Angeles on my way from Vancouver, B. C. to Mexico City. Clarence Thornton told me that the A.E.S. branch in The City of The Angels was having a "Pacific Coast Convention" so I stayed over and attended it.

Boy! They do things on an intelligently magnificent scale in "L. A." Their educational session was one well worth any plater's time and expense to attend.

Our old friend "Ernie" Lamoureux is justly considered "The Dean" of the plating industry thereabouts. He was largely responsible for the sumptuous dinner-dance so well served.

You remember delegate Reinkofs who did such a good job of "Selling" Los Angeles when we were at Rochester. He is a mainstay of the branch.

President Thompson and Secretary Coffin did their parts in a way of quiet and efficient dignity.

Freddie Gumm showed his interest in our society also by his presence.

On Freddie's urgent invitation to be with him at Newark on Saturday, April 10, I cancelled the Mexico City part of my trip to be with the boys at Newark.

Yours very enthusiastically,
WILFRED S. MCKEON

ANNOUNCEMENT

"A recent announcement by E. D.McAleer, Vice President, of the McAleer Manufacturing Company, 2431 Scotten Avenue, Detroit, Michigan, one of the largest producers of compounds for buffing all metals and finishes, appoints the Crown Rheostat and Supply Company, Chicago, Illinois as an exclusive distributor of such compositions. A full stock of all types of compounds will be carried and will enable this reliable Chicago firm to render efficient and prompt service throughout Chicago and adjacent territories."

CONFERENCE ON ELECTROPLATING

Chicago, March 2, 1937

(Report by W. Blum, Chairman of the Joint Inspection Committee and Secretary of the Committee on Testing)

During the Regional Meeting of the American Society for Testing Materials in Chicago a conference was held to discuss the exposure tests of plating on non-ferrous metals that are now in progress, and also methods of testing electroplated coatings. The increased interest in this subject is indicated by the fact that about 75 persons attended the sessions. It was especially gratifying to see present so many platers, as well as chemists who are directly connected with plating.

At the morning session, held under the Joint Committee on Exposure Tests, the results of the experiments in progress on exposure of plated non-ferrous metals were summarized by the chairman. Evidence was presented to show that the numerical scale used for rating the specimens yields consistent and apparently significant results.

Attention was called to the fact that most of the nickel coatings on the non-ferrous specimens were much thinner than those used in the previous tests on steel, in accordance with the usual practice in industry. It was found that in general there was less rapid failure of the plated copper and brass than that of steel with coatings of the same thickness, and that discoloration on plated copper and brass was usually caused by a thin tarnish film.

Especially in industrial locations it was found that the rating of the extent of corrosion was hindered by the appearance of tarnish films on the surface of the specimens. Preliminary tests indicated that when the surfaces were cleaned with a mild abrasive, the original appearance and luster of the chromium plated surfaces were nearly restored. If a thin film of oil or wax was then applied to the cleaned surfaces, it retarded subsequent corrosion and facilitated the removal of any tarnish.

It was therefore recommended by the conference, and subsequently approved by the Joint Committee, that in the near future, supplemental tests of certain sets be started. For each of these, a few new specimens will be installed and will be cleaned and treated at regular intervals. In addition, the exposure of untreated specimens will be continued, so that ultimately the behavior of the various coatings under both sets of conditions will

be observed. Pending the results of such tests, no conclusions or recommendations will be published by the Committee.

C. A. Vincent-Daviss exhibited color photographs of the specimens at various locations. The results were more interesting and instructive than ordinary black and white pictures, and they will serve as a valuable impersonal record of the behavior of different coatings. One problem that is still to be solved is the photographing of bright surfaces, in which either the sky or surrounding objects are usually reflected.

It will be recalled that in 1935 the American Electro-Platers' Society and the American Society for Testing Materials adopted tentative specifications for plated coatings of zinc, cadmium, and nickel plus chromium, on steel. These specifications have been widely circulated and have no doubt been employed to a considerable extent, either literally or with a slight increase or decrease in coating thicknesses. Very few explicit reports or comments have been received by the committee. As, moreover, a few new steel specimens are included in the tests now in progress, it was recommended that for the present the specifications be retained as tentative. Electroplaters, chemists, and engineers are urged to try out these specifications wherever they are adaptable, and to report their experiences to W. M. Phillips, Chairman of the subcommittee on specifications. This is the only way in which the committee can learn and meet the needs of industry in this field.

The afternoon session was conducted by the special committee on methods of testing plated coatings, of which W. M. Phillips is chairman.

In a discussion of the metallographic method, it was reported by several persons that the new transparent plastic, known as "Lucite," is very satisfactory for mounting specimens.

Among methods for stripping plated coatings for measuring the average thickness, a new solution developed by A. Brenner and P. W. C. Strausser for anodically dissolving nickel from copper and brass was described. The specimens are made anodic in a solution containing 100 g/l of sodium thiocyanate (NaCNS) and 100 g/l of sodium bisulphite ($NaHSO_3$). A potential of about 2 volts is applied, which produces a current density of about 20 amp/ft^2. When the nickel is entirely dissolved a thin black film remains on the copper, and can be removed by light scrubbing or by solution in cyanide. The loss in weight represents the amount

of nickel present, with an accuracy of about ±5 percent.

The dropping tests for zinc and cadmium coatings and S. G. Clarke's new "jet" method for nickel and other coatings were briefly discussed. A slight modification by P. W. C. Strausser of the "spot" method for chromium coatings was described. One drop of concentrated hydrochloric acid (sp. gr. 1.18) is applied to the surface within a small circle of wax, which has been applied by a tube dipped into molten wax. The chromium surface under the acid is then touched momentarily with a fine nickel wire in order to start solution immediately. The time from the beginning to the end of the bubbling is noted with a stop watch. Under these conditions it requires 10 ±1 seconds to dissolve each 0.00001 inch of chromium. The "chord" method, described in NBS Research Paper 866, for measuring the thickness of any coatings above about 0.0002 inch, was reviewed and briefly discussed.

A new magnetic method devised by A. Brenner for measuring the thickness of nickel on non-magnetic base metals such as copper, brass, and zinc, was demonstrated. Details of this method will appear in the NBS Journal of Research and the Monthly Review in the near future. As the method is non-destructive, it will probably be very useful in routine factory testing of such articles as plumbing fixtures and automobile hardware.

Methods for detecting and measuring the porosity of plated coatings were discussed, but little definite information appears to be available. This subject is being studied by P. W. C. Strausser, Research Associate. There is also a need for more information on the value of accelerated tests for plating on non-ferrous metals.

The committee expects soon to distribute exact descriptions of those methods that may warrant inclusion in specifications. It is hoped that many chemists and platers will give these methods a thorough trial, and will report their conclusions, either favorable or otherwise, to W. M. Phillips, General Motors Corporation, Detroit, Michigan, chairman of the special committee. Only through such cooperation can rapid progress be made.

On March 2d, the Research Committee held a meeting, at which 8 of the 12 members were present. Plans were discussed for raising the funds necessary to complete the above investigations. Here again, the chemists and platers can render a real service to themselves, their employers, and the public by giving their assistance to the Research Committee in this important project.

Here and There

On Wednesday evening, March 10, there was a meeting of Montreal Branch. Although we did not expect a visitor from the United States, our Executive Secretary, W. J. R. Kennedy was present.

Nearly all members were on hand. There was a general discussion for several hours regarding the future welfare of the Branch. There are many problems peculiar to Montreal Branch that have to be taken into consideration — one being the distance separating some of the members which makes it next to impossible for them to attend the meetings regularly.

There are however, some bright aspects, the principal one being the number of young men from the group that should be given every opportunity to show what they can do to build up the membership which has been at a standstill for several years. That an infusion of new blood would be worthwhile move goes without saying. It has worked in other branches and as long as these young men are available, willing and interested in the A.E.S. in Canada we hope they will receive encouragement and be given positions of responsibility at the forthcoming annual election of officers.

Many details connected with the Branch were discussed, such as a central meeting place; the advisability of securing speakers to present line topics for discussion; the membership drive, etc.

Two familiar faces were noticed in the group — John J. Feeley, Past Supreme President of the A.E.S. and John T. Cronin, who spent several years with the Westinghouse Co. at Springfield. We were pleased to greet both of these members.

Looking over the field and speaking with members and officials connected with the Branch, we believe there is a possibility of building up the Society, as there are eligible persons not now members of the A.E.S. who would join, if given the right perspective regarding our aims, objects and requirements. A real live membership chairman with the united support of the members would do a lot to start things in the right direction.

Our visit was made at the suggestion of some members of the Executive Board. We were not invited to go by the Branch. We hope to visit Montreal in the near future, at the invitation of the members, trusting that all differences of opinion will be settled.

Financially Montreal Branch is in good standing, all per capita tax dues being paid up to date. Our desire is to see this Branch keep in step with the other twenty-seven branches. It will be disappointing to all of us if our Canadian members in Montreal do not start to build up their membership. It is also hoped that a good representation will be present at the New York Convention.

Best of luck boys. We were glad to meet you. We want you to keep the genial secretary of Montreal Branch, Charlie Doherty, busy signing applicatoin blanks and reporting future developments and activities.

NEW HAVEN BRANCH

At the first meeting of New Haven Branch on Friday evening, March 19, at Yale University, the chairman of the Educational Committee, Mr. Tom Chamberlain gave an outline of the Branch activities starting this month and continuing until the end of June. The meetings will be continued again in September after the summer vacation.

The meetings will be held in the University. This in itself is a big advantage inasmuch as the chemical laboratories are at the disposal of the branch. In addition to this some members of the faculty will also lend assistance. The classes are expected to grow rapidly, also the branch membership. Charlie Costello, the enthusiastic secretary, is so optimistic that he asked us to send him a pad of application blanks.

New Haven Branch is now working under a temporary charter granted February 15, 1937. Thirty members have been transferred to New Haven Branch from Bridgeport. Both branches are to be congratulated for the fine fraternal spirit shown all through the proceedings. Bridgeport and New Haven have a splendid opportunity to build up their membership since both cities are in the center of great manufacturing areas, where many platers are employed who have not yet enrolled as members of our organization.

NEW BELKE PLATING BARREL

A new, more rugged plating barrel has been placed on the market after nearly four years of laboratory research and development by the Belke Manufacturing Company of 947 N. Cicero Avenue, Chicago, Illinois. Hundreds of different types of hard rubber fabrications were tested before Belke engineers developed the caustic resisting MICA RUBBER of which this unit is made. This new product is impervious to all solutions and will withstand any plating temperature without warping or buckling.

Belke Construction Gives Extra Strength

An exclusive feature of Belke design is the method in which the cylinder walls are fitted to the barrel ribs. Here Belke construction provides three times more wearing surface by machining the panels into the ribs at a 15 degree angle instead of the usual 45 degree. The barrel motion is also reversible so that when the gears and ribs begin to show signs of wear the motion may be reversed. This will enable a barrel to give twice as much service. Hard rubber coated steel girders encircle the cylinder for extra support. Heavy, hard rubber coated, steel reinforcements are also used for the two ribs on each side of the door. The hangers on the Belke barrel are bolted securely to the supporting bar with eight large steel studs, eliminating any possibility of weaving. The cover panel is held in place with sturdy, hard rubber covered spring clamps which are designed to make loading and unloading a matter of only a few seconds.

Solid, Continuous Cathode Lead Eliminates Treeing

To insure the highest efficiency of current usage in the Belke barrel; there is one continuous, lead-in cable sheathed in layer upon layer of rubber. This eliminates intermittent contacts and makes treeing impossible. The new cathode contacts are heavy, flexible, insulated cables extending from each end of the barrel. Large chrome plated steel knobs are at the ends. These bear down on the work to provide positive contact and uniform current distribution. This exclusive Belke feature eliminates danglers and prevents absorbtion of metal in the solution, thereby speeding up plating.

Replaceable Bushings on Hangers and Barrel Flanges

Another new and important feature in the construction of this barrel is the replaceable bushings in the hanger where the small driving gears rotate. This enables speedy and economical replacement of only bushings instead of entire hanger construction. Bushings are also used where the barrel rotates on the hanger axel. When the bushing wears out, you merely replace them at a small cost.

RECTIFIER PROVIDES NEW SOURCE OF DIRECT CURRENT

Copper Oxide Plate Type Rectifiers provide a new, practical means of converting alternating current into direct current for use in the electroplating industry. This equipment is manufactured exclusively by the Hanson-Van Winkle- Munning Company, Matawan, N. J., in connection with the Westinghouse Electric and Manufacturing Company.

The numerous sizes offered provide a wide range of direct current supply for use in electroplating operations. The unit consists of power transformers, a small fan for air circulation, the rectifier unit and necessary control equipment. The outfit is also equipped with a De-ion circuit breaker which serves both as a switch and a protection against overloads and short circuits.

When installed where they are free from excessive humidity, dirt and fumes, it is said the equipment will give years of trouble-free service.

Freedom from moving parts, except for a small ventilating fan, keeps maintenance costs of Copper Oxide Plate Type Rectifiers at a minimum.

Installation cost is practically nil as the outfit is simply placed into position as a self-contained unit. Additional features of this equipment include a high overall efficiency and high power factor.

ROHLEDER MADE CHIEF CHEMIST OF MAAS & WALDSTEIN COMPANY

Charles F. Rohleder has been appointed Chief Chemist of Maas and Waldstein Company, makers of industrial finishes, Newark, New Jersey, according to an announcement issued by Gustave Klinkenstein, Vice-President and General Manager of that company.

Mr. Rohleder, was graduated from Cooper Union, New York, in 1926, with the degree of B. S. in Chemistry, and has spent all of his professional life in the industrial finishing field. His experience includes research, production control, and supervision of production. He is a native of New York City and is living at present in Belleville, New Jersey.

Maynard J. Creighton, general manager of the Zapon Division of the Atlas Powder Company at Stamford, Conn., was elected to the Board of Directors of the Atlas Powder Company at the recent annual meeting.

Mr. Creighton joined the Atlas Powder Company in 1915, the same year in which he was graduated from the University of Maine. After general experience in various plants and at the Perryville Ammonium Nitrate operations, he was transferred to the Wilmington office of the company in 1919 to take charge of the Research Division.

In 1924 he became associated with the Zapon Company and became genera manager of the division in 1935. In this capacity he has charge of all cellulose products manufacture and all sales for the company, including industrial finishes and coated fabrics. He also is in charge of the Zapon Brevolite Division with plant and offices at North Chicago, Ill.

ANNOUNCEMENT

Eastern Branch

148 W. 23rd St., New York, N. Y.

Because of a greatly increased volume of business transacted during the past year in the Eastern States — and anticipating a greater demand in the future —

— due to new products already announced, other new units to follow, and increased demand for the old—

— we hope to better serve our friends through the establishment of a "home-plate" here in the east.

HAMMOND MACHINERY BUILDERS

KALAMAZOO, MICHIGAN

PROPOSED AMENDMENTS TO THE CONSTITUTION

We the members of Chicago Branch of the American Electro-Platers' Society in regular meeting this date, recommend to the Supreme Society in annual meeting, 1937 at New York, N. Y., the following amendment:

To Wit; Art. III. - Part I - Section 1 and 2.

The officers of the Supreme Society shall be, a President, a Retiring President, a First Vice-President, a Second Vice-President and a Third Vice-President.

The Executive Board shall consist of all the Supreme Officers.

To Wit; Part I. Article IV. Sec. 1, Page 3.

It shall be the duty of the President to preside at all meetings of the Supreme Society, to preserve order, to put all motions before the meeting if duly seconded, to decide all questions of order subject to an appeal to the meeting, to give the deciding vote in case of a tie, and shall in honor of his office, be a member of all committees. He shall call all special meetings and all meetings of the Executive Board that may be necessary, which shall be held at the Branch that is nearest the geographical center of the Society, based upon the location of all Branch Societies, and state in writing the object of such meeting. He shall appoint all committees not otherwise provided for; in the absence of an officer, appoint a member to act during his absence, and when an officer resigns, or dies, appoint a qualified member to fill out the unexpired term.

G. JELINEK, *President*,
J. W. HANLON, *Secretary*.

We of the Chicago Branch of the American Electro-Platers' Society wish to offer the following Resolution to the constitution of the aforesaid Society in convention, and hope that it may be included as part of the constitution, or as an amendment thereto.

To be known as Art. IX., Part 2, Section I.

Each Branch Society shall be entitled to one (1) vote for each ten (10) members, and where a Branch has less than 10 active members only one (1) may be allowed said branch.

Branch societies may send as many as three (3) delegates to represent them but the voting power shall be on the ratio of one (1) vote for each ten (10) members in good standing with the Supreme Society Secretary's Office on the opening day of the Annual Convention. The voting power may be divided by the delegates representing the Branch, per agreement or by instructions from the Branch, and the same to be registered with the Supreme Secretary at the start of any balloting.

And that all delegates must qualify as active members per the Constitution of our Society without any deviation, and the Credential Committee must report results of their findings before delegates can be seated.

G. JELINEK, *President*
J. W. HANLON, *Secretary*.

At a regular business meeting of the Boston Branch on April 1st, 1937, it was voted to sponsor an amendment to the A. E. S. constitution viz.: Article II to be amended to read as follows:

ARTICLE II

Sec. 1. The membership shall consist of two classes to be called respectively: Active and Honorary.

Sec. 2. Active membership shall be open to any person (professing and showing) interest in the advancement of the Science and the Art of Electroplating and the dissemination of the knowledge of its practice.

Sec. 3 *to Sec.* 10. to read as written in the present Sec. 5 to Sec. 12.

ARTHUR MINTIE, *President*.
ANDREW W. GARRETT, *Secretary*.

Educational Programme of the Silver Jubilee Convention

NEW YORK — 1937

Gold Electroplating.....Newark Branch

Barrel Finishing.....Waterbury Branch

Copper Plating in Cyanide Baths.....Rochester Branch

Health Hazards in Plating Room.....Cleveland Branch

Brass Plating.....Bridgeport Branch

A Discussion on Barrel Electroplating.....Philadelphia Branch

Cathode Efficiency of Electro-Plating Barrels and Its Effect on the Adhesion of Nickle Deposits..Albert Hirsch, Pres. Philadelphia Branch

Electroplating Practice in Germany.....Walter Meyer

A Resumé of Silver Plating.....F. C. Mesle

Summary of Researches on Electrodeposition at the National Bureau of Standards.....Dr. W. Blum

Progress Report on Exposure Tests and Laboratory Tests of Plating on Non-Ferrous Metals.....P. W. C. Strauss & W. Blum

The Use of Color Photography in the Inspection of Exposure Feats of Plating.....C. E. Vincent Davies & W. Blum

A Magnetic Method for Measuring the Thickness of Nickle Coatings on Non-Ferrous Metals.....A. Brenner

Lacquers.....Dr. Gustav Klinkenstein

The pH of Alkaline Plating Solutions.....George B. Hogaboom

Something New in Silver Plating.....Donald Wood, Reed & Barton Co.

Air Conditioning of Plating Plant.....F. DeLorme, Boston Branch

The 1937 Convention of the A. E. S.

The Silver Jubilee of the Society in New York City

June 14, 15, 16 and 17th

AT THE PENNSYLVANIA HOTEL

directly opposite the Great Pennsylvania R. R. Terminal

A GRAND HOTEL **A GRAND LOCATION**

in

The very heart of Manhattan

101 reasons why all interested in metal finishing should attend this Convention. Here are a few of them:

An Educational Programme of merit and novel in feature, with presentations from such authorative contributors to the science of electro-plating as:

Frank Mesle of Oneida Community, Inc. "A Resumé of Silver Plating."

Albert Hirsch, President Philadelphia Branch, Electro-Plating Instructor at Jules Mastbaum Vocational School, "Cathode Efficiency of Electro-Plating Barrels."

Walter Meyer of General Electric Company, Bridgeport Branch, "Electro-Plating Practice in Germany."

George B. Hogaboom of Hanson-Van Winkle-Munning Company, "The pH of Alkaline Plating Baths"

and

Six composite papers from six branches of the A.E.S. representing the work of the foreman plater and embodying his experience in practice. A contribution long desired.

THE ENTERTAINMENT PROGRAMME

under direction of Ben Popper of Egyptian Lacquer Company

and

Thos. Trumbour of International Fellowship Club

Open House night as guests of the Fellowship Club — An evening of music, dancing and refreshments to all registrants at Convention.

A tour of the Greater City in De Luxe coaches to points of known interest.

A tour of the World famed Rockefeller Center, including the National Broadcasting Station.

An inspection tour of one of the great ocean liners at anchor in New York Harbor.

A behind the scenes tour of "Macy's" the nation's largest department store. An innovation for the ladies.

The Grand Closing Banquet and Floor Show. A Jubilee Souvenir for the ladies. One to remember.

EXHIBITS

Individual and Branch Exhibits of plated finishes and products at the Pennsylvania Hotel. An opportunity for the various Branches to try for the Metal Industry Cup, for perfection of finish.

An exhibit of plating and finishing equipment, products and wares under the auspices of the Metal Products Exhibits, Inc., to run concurrently with the time of the Convention at International Building, Rockefeller Center. An exhibit of high interest, in commodious quarters, in a modern setting, amid fine appointments.

A series of events and happy episodes long to be remembered by those who gather to celebrate the quarter century of progress of the A.E.S.

REGISTRATION FEE

Gentlemen $9.00 Ladies $6.00

NEW YORK CONVENTION COMMITTEE

FRANKLYN J. MACSTOCKER

General Chairman

Novelty **Lacquer** *Finishes*

By GUSTAVE KLINKENSTEIN
Vice-President and Technical Director
Maas & Waldstein Company
Newark, New Jersey

COATING surfaces for protection and adornment dates back to the beginning of civilization. During the course of time artisans combined various types of wood, metals, minerals, semi-precious and precious stones to decorate and enhance the appearance of many things.

In the early days the work was done by hand and was carried on slowly and laboriously. To decorate and finish a few pieces took anywhere from a week to a month. But nobody can deny that they were beautiful and enduring. We have as examples of the old art such finishes as Japanese lacquering, gilded and color glazed china and cloisonne work.

Today, through the work of the electro platers, lacquer chemists and spray gun engineers, we have reproduced some of the old finishes and developed many new ones. We have also reduced the time and labor consumed from days to minutes.

Various finishes will be described. All of them are not new. Some of them are old finishes that have been treated just a little differently. The ideas for a few of them originated right among yourselves.

ANTIQUE CHECKING FINISHES

At some time or another some one of us has been called upon to simulate the appearance of an antique piece of china or wood. This can be done by applying a spray coat of colored lacquer enamel followed by a spray coat of Checklac. The Checklac cracks open on drying, giving a very close resemblance to antique check-

ing. This finish should not be confused with crackle enamels which do not have the same formation.

MOTTLE PEARL CELLULOID EFFECT

There are many mottle pearl celluloid toilet articles being sold today. These have a very pretty finish which can be closely copied on wood or metal by applying a first coat of lacquer enamel in the desired color, followed by a spray coat of special pearl paste. The surface may be rolled with a twisted chamois or sponge mounted on a roller. This picks up part of the special pearl paste and produces the mottle effect. A topcoat of lacquer finishes the job.

WRINKLE FINISHES

The wrinkle finish is very useful as it makes possible a one coat job on rough metal. The clear or colored wrinkle is baked for one hour at 300° F. or at a lower temperature. A coat of lacquer enamel can be applied over the wrinkle if a color change is desired. A novel three-color effect can be produced by spraying almost horizontally across the top with Bronze Lacquer and Fire Red Bronze Powder. Reverse the panel and spray the same way with Bronze Lacquer and Patent Blue Powder. The finished panel viewed from various angles shows different color effects.

COLORED STIPPLE FINISHES

The stipple finish is not new but it can be modernized and made more attractive by making a variation from the usual small stipple pattern or coating it with Silver Metalustre Enamel and smutting it with Green Japan, Black Japan, etc.

CRYSTALLIZING LACQUER FINISHES

A wide variety of effects are possible using Prismlac or crystallizing lacquers and enamels. These lacquers can be applied by a brush, dip or spray. During drying the surface becomes ornamented with crystals that gradually grow larger and cover the entire area. Clear Prismlac can be applied over ordinary lacquer enamel by the use of a clear sealer as an intermediate coat. It can also be applied directly to brass or other metals producing a

very attractive ornamental finish. The clear crystalline finish can be modified and given an etched appearance by smutting the surface with Black Japan. Another attractive variation of Prismlac is obtained by applying a spray coat of Black Crackle Enamel over clear crystallized lacquer. The crackle enamel breaks open following the lines of the crystal formation.

METALLIC FINISHES

A new ornamental one-coat finish, called Metalustre, has recently been introduced. This finish combines the brilliance of a metal background together with color. It is especially useful in lacquering low price novelties where the finishing coat is limited to one coat. The Metalustre finish approaches the beauty of the much more expensive pearl finish.

TRANSPARENT COLORED METALLIC FINISHES

A new line of enamels, when mixed with clear lacquers, give a clear, brilliant transparent colored effect to metals of all kinds that is fast to light and very durable. This new type enamel is known as Platelustre and is supplied in a large assortment of colors, permitting the reproduction of all popular chemical metal coloring effects, as well as making possible new effects, without the use of chemical processes.

FLOAT ENAMEL FINISH

Float enamels, as the name indicates, are floated on water and then picked up on the work. Single or multiple colors can be floated on water and then picked up over a colored background. In doing the work the thinned float enamels are sprinkled on the surface of the water contained in a suitable tank. The work is dipped into the water, through the float enamels, and then withdrawn.

WEBBING LACQUERS

Webbing or marbleizing lacquers are lacquers that have been made so that they string out in fine threads or cobwebs when they are sprayed. Interesting effects can be produced with one, two,

or three coats of marbleizing lacquer applied over a colored background. This finish is best applied using a special spray head that has been developed for the purpose.

FLOCK FINISHES

The flock, or Swaydex, finish presents the very interesting possibility of applying a suede-like cloth finish to any object. The development of a new type of spray gun has made practical the application of finely divided cotton or rayon with air. Ground coat colors have been developed that stay wet and sticky for a period of fifteen minutes. This allows the flock to be blown on the surface and anchor without any trouble. After the flock has been applied and the groundcoat has dried, the finish looks like a piece of suede leather. The finish is open to many variations. Different colors can be applied through stencils, it can be combined with lacquer enamel in sectional spraying, it can be colored with concentrated colors by stencil work. Flock can also be combined with very coarse bronze powder to produce a very attractive glitter effect combined with the flock finish.

MULTITONE FINISHES

A multitone finish, which is open to considerable variation, produces a varied colored or metallic mottle on the surface. Many interesting color combinations can be obtained. This finish is produced by applying a spray coat of any Metalustre or colored pigmented lacquer enamel as a ground coat. The groundcoat should be allowed to set for 2 or 5 minutes then a spatter coat applied of special multitone thinner mixed with either a small amount of lacquer enamel or bronze powder. During the drying the color or powder separates producing the multitone effect.

HAMMERTONE FINISH

This is a new finish that combines the effect obtained in the multitone finish with the rough stipple effect that gives the sur-

face the appearance of having been hammered. It is open to many interesting color combinations.

CRACKLE FINISHES

In general, crackle finishes are old. An interesting new modification of the crackle finish is to apply a solid color coat over a clear crackle enamel which produces an effect very similar to leather. The old crackle finish will always produce many desired crackle color combinations by choosing the desired colored ground-coats and crackle color.

MISCELLANEOUS FINISHES

Interesting effects can be made by using combinations of some of these finishes. For example, marbleizing enamels and crackle finishes combine well, and so do marbleizing enamels and crystalizing lacquers.

Among the older novelty finishes that are still widely used because of their attractiveness when appropriately applied are the following:

Spatter finishes, *burnished finishes*, and *shaded finishes* obtained by applying a contrasting shading color over backgrounds consisting of light or dark pigmented lacquers, Metalustre enamels, or bronze powders.

Mottle Finishes obtained by applying a darker color over a suitable lighter colored background with a rag, brush, or mottling sponge.

Antique finishes obtained by smutting the low-lights with any appropriate color representing the material or finish being simulated.

The finishes that have been described do not by any means exhaust the possibilities that exist for creating novel and beautiful effects, and it is hoped that this discussion will serve to stimulate the imagination of workers in the finishing field to still further develop this interesting art.

INTERNATIONAL ELECTRODEPOSITION CONFERENCE

LONDON, 1937

The Electrodepositors' Technical Society is issuing a complete volume of the above Conference. The volume will contain all papers read at the Conference discussions, report of the proceedings, etc.

The price will be approximately $3.00 plus import duty if any.

Information regarding the sale of the book can be obtained from Mr. E. A. Ollard, Stanfred Sykecluan, Iver, Bucks., England.

NOTICE

The Lea Mfg. Co., Waterbury, Connecticut, is marketing a bulb-type pump for drawing acids and other corrosive liquids from carboys and other similar containers. The tubing used is glass which is resistant to the corrosive acids and alkalies. This type of Pneumatic Pump operates faster than a syphon as it applies the proper pressure to the surface of the liquid. Normal capacity is about 2 gpm but higher capacities are obtainable by a more rapid manipulation of the bulb. A relief valve is opened to vent the unused pressure. Noxious or dangerous fumes do not escape. The price of the pump is $8.50 f.o.b. Waterbury.

On Saturday evening, April 24th, 1937 at 7 P. M.

Milwaukee Branch A.E.S. will hold their annual Educational Meeting and Smoker at the Schroeder Hotel (Crystal Ballroom), North 5th Street and West Wisconsin Avenue, to which you are cordially invited. The committee has arranged a fine educational meeting. Well known speakers will present papers on the latest developments in the Electroplating field.

1. The Control of Electro-deposits by Wm. Geismann.

2. Silver plating wire for the manufacture of tinsel products. Courtesy of the National Tinsel Co., Manitowoc, Wis., by Max Ackermann.

3. Problems in a modern plating department. Joint paper by Cutler Hammer staff, will be read by Phil. Ritzenthaler.

4. George Hogaboom. Courtesy of the Hanson Van-Winkle Munning Co.

Question Box. Bring your plating problems for discussion, as there have been many new developments in electroplating during the last few years. We think this get-together for discussion will be a clearing house for an exchange of the methods of new processes and developments. Find out where you stand and learn if your process cannot be improved.

There will be a time limit for each discussion. All persons interested in electroplating are cordially invited, do not miss this chance.

The educational program will be followed by entertainment and a buffet lunch with plenty of the refreshment for which Milwaukee is famous. A high class entertainment will close the session. A small fee of $2.00 per person will cover all expense. We are enclosing tickets for your convenience. An early reply will be appreciated.

Address all communications to A. J. HERMANSEN, 539 No. 99th St., Wauwatosa, Wisconsin.

MILWAUKEE BRANCH, A. E. S.
Smoker Committee.

Business and Social News

BRANCH NEWS

Educational Activities

AMERICAN ELECTRO-PLATERS' SOCIETY

CLEVELAND BRANCH

The regular monthly meeting of the Cleveland Branch of the American Electro-Platers' Society was held at Hotel Cleveland, Saturday, March 6, 1937.

The meeting was called to order by our president Mr. W. Scott at 8:15 P. M.

Minutes of the previous meeting were approved as read.

Application for membership was made by Mr. Richard M. Smith, foreman at the Cleveland Graphite Bronze Company.

The election of Mr. John Hyduke of 3554 E. 108th Street, connected with the Durable Plating Company of Cleveland, was voted on and he was elected.

The transfer of Charles Anger was read and we are very sorry to see this valuable member leave us, as he was very active in our Branch affairs.

We had Dr. Blum here to give us a talk on Methods of "Testing Electro-Plated Coatings" on Wednesday, February 24, 1937, in conjunction with the Electro Chemical Society. We had a very nice turnout and the boys all appreciated the paper and slides very much.

Report of committee on Entertainment was accepted on a motion made by Mr. Mullinnix and seconded by Mr. Thompson. Committee was given vote of thanks.

Correspondence was read and motion by Mr. Mullinnix and seconded by Mr. Schmotzer that papers from New York branch, Lea Mfg. Company, Milwaukee Branch and Chicago branch be reread at future meetings.

Our librarian then took over the meeting in order to get some more information on the paper he will present at the convention on "Health Hazards in the Plating Room." Mr. Camel of Plating and Galvanizing Company agreed to write a paper on Cyanide poisoning, cure and recommendations. Mr. Ott of Wellman Bronze and Mr. Peterjohn of Virden Company was to write on Chromium and make recommendations in the next two weeks and to mail to our librarian so he can put all information in a paper to have ready at the next meeting, April 3rd, 1937.

This was the largest turnout that has ever attended any of the meetings since I have been connected with the branch and our first meeting at Hotel Cleveland. Here is hoping that they continue.

Our future meetings will be held at Hotel Cleveland.

Meeting adjourned at 10:30 p. m.

W. E. O'BERG, *Sec.-Treas.*

DAYTON BRANCH

The regular monthly meeting of Dayton Branch was held at the Y.M.C.A. Saturday, March 6 at 8.00 P. M. with our President, Mr. Abbott, presiding. After calling the meeting to order and welcoming the visitors the meeting was turned over to our Librarian, Mr. Connley, who had secured as the speaker for the evening, Mr. Hull of the Grasselli Chemical Co.

Mr. Hull spoke on "Science in the Plating Room."

An unusually large crowd was on hand to hear the speaker, and his efforts were greatly appreciated by all present.

At the conclusion of his talk Mr. Hull was given a rising vote of thanks.

This last meeting was one of the best we have had and all the members were very optimistic about the future of Dayton Branch.

Five new applications were received and as many more were promised for the next meeting.

It was decided at this meeting to change the place and also the day of the meeting.

During the next three months our regular monthly meetings will be held at the Engineer's Club on the first Friday night of each month.

The speaker for our next meeting will be Mr. R. E. Maeder from the Frigidaire Corp. A large crowd is anticipated for this meeting and also several new applications.

WARD B. PROTSMAN, *Sec.*

CHICAGO BRANCH

A special meeting of Chicago Branch was held, February 27, 1937, at The Atlantic Hotel.

As this was purely an Educational meeting all business was put aside and the meeting turned over to Mr. O. E. Servis our Librarian.

Dr. W. Blum, U. S. Bureau of Standards talked on the Testing of Electroplated Coatings. Dr. Blum's talk and demonstration of the Bremmer magnetic method of testing the Nickel plated thickness of non ferrous metals was the object of much interest as 125 men were present at this special meeting. This was very gratifying to the Officers of Chicago Branch as the time was so short to arrange a meeting of this importance.

Dr. Blum answered the many questions put to him in the discussion which followed his talk, in a most masterful way. Chicago Branch officers and members were indeed thankful to Dr. Blum for addressing our Branch.

J. W. HANLON, *Sec.*

DETROIT BRANCH

Minutes of the meeting of the Detroit Branch, A. E. S., held at Hotel Statler, Thursday evening, February 25, Mr. A. B. Wilson, presiding.

Minutes of the previous meeting were read and approved. The following applications were reported on by the Board of Managers and they were unanimously elected to membership.

A letter from the Chicago Branch was then read with two proposed amendments to our Constitution. These were laid on the table to be taken up later.

A letter from Mr. Rolfe, chairman of the program committee, New York Branch, for the Convention of 1937, was read regarding papers to be read at the Convention. Our President, Mr. Wilson, appointed Mr. W. W. McCord to solicit members of the Detroit Branch for papers for the Convention.

Quarterly report of membership wathen read as follows: Previous mems bership report, 102. Applications received, 13. Applications elected, 13. Members re-instated, 3. Total membership gain, 16. Members suspended, 9. Members died, 1. Total membership loss, 10. Net gain, 6. Present membership, 108.

A letter from Mr. R. S. Leather was then read. He asked that any member having group photographs of Conventions or gatherings of platers prior to 1930, that he would appreciate very much to either purchase or borrow these, so that he could reproduce same for an exhibit at our next convention in New York.

Dr. Blum, of the Bureau of Stand-

ards, Washington, D. C., was then introduced as the speaker of the evening. His topic was "Different methods of testing electro-plated deposits or coatings." His talk was very interesting and educational. After his talk there were many questions put to him, which he answered quite satisfactorily.

The Question-Box was then opened, and there were quite a few questions found. Our acting Librarian, Mr. B. F. Lewis, not being present, Mr. Spencer was asked to act for the evening. Most of the questions were laid over till next meeting and those that were answered will be taken up again at our next meeting, when we expect Mr. Lewis to be present.

Meeting adjourned at 11 P. M.

T. C. EICHSTAEDT, *Sec.-Treas.*

MILWAUKEE BRANCH

Milwaukee Branch of the A.E.S. held its regular monthly meeting at Lipp's Hall, March 11, 1937, and all officers were present. John Miszewski, Jr., chairman of our April 24th smoker reported that all was in readiness and it was now up to the membership to get as many interested men to attend as possible, so we could enjoy another real Milwaukee meeting.

Two new members were initiated to membership, Mr. Claude Terril, as associate, of the well known J. B. Ford Co. and Mr. Ralph J. Paddock, active, chemist and foreman of the Aluminum Goods Mfg. Co., Manitowoc, Wis. We hope and believe these two men will be valuable assets to the Milwaukee Branch and also to the national organization.

Phil J. Ritzenthaler gave a good resumé of the Chicago meeting of the A.S.T.M., telling us of the many new developments that are coming up relative to the testing of plated coatings, namely: magnetic method, new drop method, and solid stream method. These methods need considerable development yet.

Our librarian, Henry Bornitzke, showed us some novel chrome plating racks and also a new coating material, which will stand up well in chromium plating.

Question: What causes cadmium plating racks to discolor pieces that are plated, unless the racks are stripped each time?

Ans. The cadmium on the rack hooks apparently casts a smudge on the pieces plated, this being especially true if a hot acid is used as a pickle in the plating cycle. If anyone else has had any experience in this line, we would appreciate any additional information.

A. J. HERMANSEN, *Sec.-Treas.*

NEW HAVEN BRANCH

The first meeting of the newly formed New Haven Branch, American Electro-Platers' Society was held on Friday, March 19, 1937.

Arrangements have been made with Yale University to hold meetings at the Sterling Chemistry Laboratory on the first and third Tuesday of every month. The University has promised every cooperation to the branch. Instructors and professors are available for lectures, and a laboratory course is promised for the fall.

At the opening meeting the following were appointed to act as temporary officers until the regular elections in May:

President, Wm. Bridgett, 286 Ward St., Wallingford.

Vice-President, Jos. Downes, Remington-Rand, Middletown.

Secretary-Treasurer, C. H. Costello, 1285 Boulevard, New Haven.

Librarian, Tom Chamberlain, 97 Canner St., New Haven.

Sergeant-at-Arms, Jack Barry, 33 Maple St., West Haven.

Board of Managers, John Oberender. Leroy Brown and Albert Rosenthal.

Officers for the year 1937-38 will be recommended by the following nominating committee: Tom Chamberlain, Bob Mooney, Al Jaekle, Jack English and Joe Sexton.

Business meetings of the Branch will be held regularly by the Officers and Board of Managers. Any member may attend. These meetings will precede the regular meetings which are scheduled to start promptly at 8 P. M.

The following were appointed to the sick committee: Bob Mooney, Jack English and George Knecht.

Chairman of the membership committee is Joseph Downes and every member of the branch is a member of the membership committee.

As Librarian, Tom Chamberlain is in charge of the programs to be presented by the Branch. Tom is at present lining up a series of talks on Base Metals to be given by a Yale instructor during the next few months. It is expected that a definite program will be planned for every meeting.

A very welcome guest at our first meeting was Bill Kennedy, Executive Secretary of the A.E.S. Bill gave us a good deal of sound advice and we all appreciated his interest in our welfare.

The New Haven Branch is starting off with a membership of thirty members, and we expect to add considerably to our numbers soon as there are a large number of eligible men in the vicinity.

Requests for membership application blanks should be addressed either to Joe Downes or to the Secretary.

CHAS. H. COSTELLO,
Temporary Secretary.

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WATERBURY BRANCH

The March meeting of Waterbury Branch A.E.S. was held on Friday evening the twelfth in Engineers' hall; Tennant Elwin, president, presiding.

As stated at the previous session, there were no speakers; the meeting being left open for discussion in matters pertaining to the coming convention, and those of a routine nature.

Favorable action was taken on the application of Edward Dowling of the Scovill Mfg. Co., for associate membership and he was declared elected.

Application of William P. North of the Patent Button Co., for associate

membership was received and ordered to take the usual course.

Communication was received from the Bureau of Standards relative to the Conference on Electro-plating, at the Palmer House, Chicago.

Communication was received from the Chicago Branch along with a copy of the amendments to the Constitution to be offered by the Branch to the supreme society at its annual meeting. A short discussion was held on the amendments, and it was decided to lay the subject over to a future meeting.

Communication was received from R. S. Leather, relative to any old time photographs, that might be in captivity, and which were taken during the various National American Electro-Platers' Society Conventions and outings of the different Branches. Group photographs taken previous to 1930, preferred. Any member having such will confer a favor by getting in contact with "Bob."

WM. GUILFOILE, *Sec.*

NEWARK BRANCH

The regular meeting of the Newark Branch, A. E. S. was held on Friday evening, March 5, 1937 at the Krueger Club, Belmont and Springfield Aves., Newark, N. J.

The meeting was called to order at 8:30 P. M. with President Samuel Taylor presiding. The following officers were present: Samuel Taylor, President; George Wagner, Secretary; Paul Oldam, Librarian; George Klink, Sargeant-at-Arms; Samuel Glickenhaus and William Hodecker, Trustees.

The minutes of the previous meeting were read and approved.

A letter from the Chicago Branch with reference to an amendment to the constitution, "Whereas each branch would be entitled to cast one vote for each ten members at a National Convention," was acted upon and upon motion duly made and seconded, it was voted that the delegates of this branch to the National Convention be instructed to vote against this amendment. A second amendment to the constitution proposed by the Chicago Branch, "Whereas the Supreme Body would consists of a President, a Retiring President, a First Vice-President, a Second Vice-President, a Third Vice-President," was acted upon and voted on favorably, and it was decided to leave this matter to the delegates of this branch for their discretion.

A letter from the Lea Mfg. Co. asking for group photographs of some of our various conventions and outings was read and some of the members promised to present some of them at the next meeting.

Mr. Hogaboom suggested that Newark Branch visit the Bell Laboratories in New York City before our annual Banquet and it was decided that this visit be made on April 3, 1937 and the secretary was instructed to notify all the members to that effect.

Mr. Oldam, our Librarian, created some more interesting arguments on Gold Plating. He also stated that he had secured Mr. Fletcher, Mr. Hogaboom, Dr. Young, Mr. Bankroft and Mr. Mesle, as speakers for the Educational Session of our annual banquet.

Meeting adjourned at 12.00 midnight.

The regular meeting of the Newark Branch A.E.S. was held on Friday evening, March 19, 1937 at the Krueger Club, Belmont and Springfield Aves., Newark, N. J.

President Samuel Taylor presided over the meeting which was called to order at 8:30 P. M. The following

officers were present: Samuel Taylor, President; John Kotches, Vice-President; George Wagner, Secretary; Nelson Sievering, Treasurer; Paul Oldam, Librarian; George Klink, Sergeant-at-arms and Samuel Glickenhaus, Trustee.

The minutes of the previous meeting were read and approved.

An application for Michael Pugliese, 24 Stewart Ave., Irvington, N. J. was voted on to take the regular course.

A letter from Walter S. Barrows of Toronto, Ontario, Canada was read and discussed at his request. There were three questions in this letter which caused some discussion and the Secretary was instructed to answer Mr. Barrows informing him of the results.

Two letters were read from Mr. E. Steen Thompson, President of the Supreme Body, informing us as to the report of the canvass of the Executive Board made at our request, regarding the 1939 Convention, for permission to call it International, should Newark Branch act as host. After some discussion it was decided to hold this matter over for the New York Convention in June.

Mr. Horace Smith, Chairman of the Banquet Committee, reported that all arrangements had been made for our Annual Banquet to be held on Saturday, April 10, 1937 at the Hotel Douglas, Hill St., Newark, N. J. He urged the members to support the committee by bringing their wives, sweethearts, and friends. He further stated that the Educational Session would be very interesting due to the efforts of our Librarian, Paul Oldam, in securing excellent speakers.

Once again Gold Plating was the big subject of the evening. There is no doubt that the paper being prepared by Newark Branch to be presented at the New York Convention will be one of the best ever written on Gold Plating.

31 members attended and the meeting adjourned at 11:00 P. M.

GEORGE WAGNER, *Sec.*

PHILADELPHIA BRANCH

Philadelphia Branch held its regular meeting, March 19, 1937, President Al. Hirsch, presiding. Applications of Mr. W. S. Gross as an associate member and Mr. H. T. Mansfield, as active members were reported favorably by the Board of Managers. Voted to have the applications take their regular course.

A communication from the Lea Co. Waterbury, Conn., was read. The Secretary was instructed to forward all photos that can be obtained to Mr. Leather.

Communication from Chicago Branch relative to proposed amendments to the Constitution at the New York Convention was read. It was voted that a copy of the amendments be printed in the Quaker City Reminder. Same to be discussed at the meeting in April.

We are sorry to announce the death of one of our most loyal members, Mr. Samuel Barr. Mr. Barr was elected an active member, Feb. 27, 1911, and was president of Philadelphia Branch in 1915-16. The Secretary was instructed to forward a message of condolence to the family of the deceased. Mr. Barr passed away Feb. 25, 1937.

Our Librarian, Mr. Nelson, then took charge of the discussion of the Branch paper to be read at the New York Convention. Mr. Nelson is deeply appreciative of the response given, by the members and their willingness to help in getting the paper together. Mr. H. Keller, Mr. J. W. Himes, Mr. P. Mentzel and others discussed the subject,

which was very educational and interesting.

President Al.Hirsch notified all members that the Mastbaum Vocational Training School Electroplating class will close after a very successful year with its annual dinner and award for the best paper which is one of the features of the class. Philadelphia Branch with Pres. Al Hirsch as instructor is to be congratulated for the work done by this class during the past months.

There being no further business the meeting adjourned until Friday, April 16 at 8.00 P. M.

ROBERT E. JACKSON, JR., *Sec.*

CHICAGO BRANCH

The regular monthly meeting of Chicago Branch was held, March 13, 1937 at the Atlantic Hotel — President G. Jelinek presiding and all other Officers present.

The applications of Mr. J. J. Loop and Mr. V. Mattacotti were read and committees appointed on same.

Mr. M. F. Ehrler was elected to associate membership. Mr. E. H. Witte Mr. J. E. Lorang and Mr. J. M. Schlosser were elected to active membership.

Mr. Tom Kennedy who has just recovered from a spell of illness was present and all the members were glad to see him back among us.

A letter from Mr. J. Rolff chairman of the Educational committee for the coming convention in regard to educational papers was read and the matter was referred to Mr. O. E. Servis our Librarian.

A letter from Mr. R. Leather asking for old group photographs was read and both Mr. Gilbertson and Mr. Servis promised to send him some.

A letter from Milwaukee Branch, regarding the 1938 convention was read and referred to our Delegates, when appointed.

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A motion was made to hold our June meeting the first Saturday in June instead of our regular date, in order to allow time for our delegates and members to reach the convention.

Dr. Clinton of the State Department of Labor made a very interesting and instructive talk on Health Hazards in the Plating Industry.

The librarian found the following questions in the question box.

1. *After digesting Dr. Blum's talk on February 27, does anyone have any comments as to whether the Bremmer test is practical commercially for job shop work?*

Answer. Yes. It is a very good method for various jobs.

2. *What is the best method of cleaning high carbonated steel before chrome plating?*

Answer. Clean in an electric cleaner with direct current, dip for a slight etch in a 30% Nitric and 5% Hydrocloric acid dip, rinse and chrome plate.

J. W. HANLON, *Sec.*

GRAND RAPIDS BRANCH

The Grand Rapids Branch of the American Electro-Platers' Society held a dinner meeting at the Rowe Hotel, March 12th, with an attendance of 100 people. Guests were present from many surrounding towns including, Holland, Zeeland, Kalamazoo, Sturgis and Grand Haven. The meeting was the first of its kind in several years and the attendance and interest shown was very gratifying.

President Homer G. Morton turned the meeting over to Mr. C. O. Werft of the M. & W. Lacquer Co. who acted as toast master for the evening. He gave a short history of the society and showed one of the first issues (1909 of THE REVIEW then known as the National Electro-Platers Association Quarterly Review.

The speaker for the evening was W. M. Phillips, Chairman of the Research Committee of the A.E.S. and of the General Motors Corp. Mr. Phillips gave a very interesting talk on "The Activities of the Research Committee." He described the work that has been done at the different testing stations located in various parts of the country. This was followed by a description of the latest methods of plate thickness measurement. Principal methods mentioned were the microscopic test using a new mounting substance made by Dupont, the Mesle chord method, the drop test methods, and the new magnetic method brought out by Dr. Blum at the Bureau of Standards.

The members of the Grand Rapids Branch were very well pleased with the turnout at this dinner meeting and many of them expressed the desire that there would be a repetition of the occasion at a later date.

C. S. WHALLEY, *Sec.*

PROVIDENCE-ATTLEBORO BRANCH

The Providence-Attleboro Branch held its regular meeting at the Narragansett Hotel on Friday, March 19.

Mr. Donald Wood was announced to speak on, "Bright Plating." By way of explaining his idea, Donald used the illustration of a large number of small magnets attached to and pulling a freight car, i. e. if you use enough of them you can move the car. That the ratio of the size of ions in the plating-bath to anything one could see, is comparable to the illustration. That the charged ions in travelling to the cathode, would drag magnet-like some of the colloid or brightener and deposit it along with the metal; that the colloid affected the crystalline structure of the deposit, creating a finer, harder, and brighter plate.

By entertaining a question from Mr. Weisberg, Donald let himself in for a debate that lasted quite a while, although he seemed to enjoy it. Mr. Weisberg's contention was that bright-plating could be and, is being done without the use of colloids, citing e. g. chromium-plating, also that he had been able to produce a bright deposit for a period of over an hour by controlling the factors and the P. H.

The question of having a banquet this month was discussed and, it was suggested that we postpone it until fall.

Mr. Tyndall was present and spoke on the question, saying that we could have a social, or buffet lunch.

Mr. Weisberg suggested that we have a planning committee to map out a program for the next year.

We adjourned about 11.30. There were 16 present.

JOHN ANDREWS

BOSTON BRANCH

Boston branch met Thursday, April 1, at the Hotel Manger with Pres. Mintie in the chair.

Minutes of the previous meeting read and approved.

Communications read and placed on file bills to read and moved that they be paid.

Two applications read for the second time and elected to membership as follows: Leland G. Delong 113 Otis St., Cambridge, Mass. Associate, Walter G. Bullard, 5 Rose Ave., Marblehead, Mass.

Four applications read for the first time and turned over to the board of managers for approval as follows: Harry M. Saultzberg, 46 Wolcott Ave., Dorchester, Mass., Associate; Lester F. Pope, 27 Overlea Ave., Saugus, Mass., Associate; Charles E. Cherry, 170 M. St., So. Boston, Mass., Active and Edward J. Saulnier, 38 Manchester St., Lawrence, Mass., Active.

Louis Gale, chairman of the banquet being away, Joe Barron made the report for the advertising and stated that if all ads were paid for, the net profit will be $612.99, a few more to be paid for. The Secretary made the report for the ticket committee and stated that there are still 11 tickets to be paid for. Net will be $44.97.

A vote of thanks was given to the committee for the great work that it had done in making the Banquet the greatest held by the Branch.

The following were suspended for non-payment of dues: Evans F. Ingersall, c/o Colgate Gilbert Co., Walpole, N. H. Frederick C. Dykerman, c/o Colgate Gilbert Co., Walpole, N. H. Victor Montague, 13 Welsh St., Malden, Mass. Robert Port, Waltham Watch Co.

The Branch granted at ransfer to Francis W. Bliss, c/o Evans Case Co., N. Attleboro, Mass. from Boston Branch to Providence.

Mr. Wood made a motion that $100 be given the research committee in addition to the $10.00 already given — passed.

A motion was made that the delegates to the next convention be instructed to try and bring the convention to Boston in 1938.

Edward C. DeLorme is preparing a paper to be presented to the convention at New York, the title, "Air Conditioning of the Plating Plant."

Motion was made that Joe Barron try and arrange plans for a ladies auxiliary to Boston Branch.

Motion was made by Bert Sage that a salary of $50 a year be given the Secretary of Boston Branch, starting from the fiscal year, June 1, 1936.

A motion was made that the Branch hold its next meeting, May 7, 1937 at the Squantum Yacht Club and that we have our annual chowder supper to be served by our President, Mr. Mintie, and all our friends and the ladies will be welcome. A small charge of 75 cents will be charged to cover expenses. Don't miss Arthur's great chowder, he will have the ladies asking how he makes it.

After the regular order of business the chair was turned over to Mr. Bert Sage, a member of the Branch. He gave a short talk, the subject of his talk; "What .001 Deposit Means to Plated Articles." He gave a very fine talk explaining on the black board just what it means and also The Faraday Law showing what it cost to do work that must meet all specifications, and he answered all questions and received a vote of thanks.

We had the pleasure of taking an imaginary trip by the way of talking

moving pictures from New York to So. America with Mr. Baker, a member of Boston Branch, with Joe Barron oper ating the movie machine. What a time he had. We enjoyed it very much; only we wish we could have been with him. Thanks a lot Al. While you missed the banquet we were with you just the same. After that we went on a honeymoon trip with Joe Barron and what a time he had. And then a year later we see a new comer in the family and the pictures show how that baby has grown in eighteen months -- good luck to you Joe.

A vote of thanks was given both to Al Baker and Joe for their evening of entertainment.

Meeting adjourned at 11.15 P. M.

A. W. GARRETT, *Sec.*

DETROIT BRANCH

Minutes of the meeting of the Detroit Branch held Friday evening, April 2nd, in Hotel Statler. Mr. A. B. Wilson in the chair. There was a good attendance of approximately 65.

Minutes of the previous meeting were read and approved. There was a letter from the Milwaukee Branch relative to their meeting to be held April 24th ard it was placed on file.

Also a communication from Dr. Blum of the Bureau of Standards at Washington stating the progress of the Research Committee on the plating on non-ferrous metals. This was also placed on file.

There was a communication read from an Eastern concern who are looking for a salesman and demonstrator for the territory of Detroit and Michigan. This was also placed on file.

There were no new members elected at this meeting.

Mr. Robert S. Leather of the Lea Manufacturing Co. of Waterbury, Conn. was then introduced as the speaker of the evening. He made a few introductory remarks and stated that he did not have a paper or a speech but that he did have something which was very interesting and in fact it proved to be. There were moving pictures of our Conventions at Bridgeport in 1935 and at Cleveland in 1936. They were not only interesting but caused quite a little amusement as it shows practically all of our past presidents who are still living and the Committees of both of these Conventions at play. He also showed a moving picture of a canoe trip in Maine which was taken last summer by himself and four companions with five guides. This was extremely interesting. Mr. Leather was given a rousing vote of thanks and applause for the entertainment he had given us.

Mr. A. B. Wilson, our President, announced that at our next meeting we would have nomination of officers for the next fiscal year, also nominations for delegates to the Convention in 1937. He urged every active member possible to be present at this next meeting so that there might be a full representation and come prepared to support a candidate for the different offices.

As it is evident with the number of applications for membership herein, the new membership drive is progressing rapidly.

Mr. B. F. Lewis, our acting librarian, found the following questions in the Question Box and they created quite a little discussion. This question box is practically the life of the meetings and we are gratified to see so many questions and we request that every one who has a problem present a question.

1. *What is the proper procedure and proper solution to chrome plate bright directly on stainless steel?*

Plating of chromium over passive surfaces such as stainless steel is the subject of a patent granted Piersol (U. S. patent 1,774,901) covering the following procedure:

The object is placed on the cathode bar and without applying current the cell circuit is closed by shorting anode bar to cathode bar. After a few seconds the cell circuit is opened and the plating current is applied.

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It has also been recently suggested in connection with passive bright nickel surfaces that a cyanide cleaner be used to activate the surface.

Also stated by authority that stainless steel can be successfully (chrome bright) plated by regular cleaning and plating. Same as nickel plated work.

2. *What is the best composition for a cyanide copper bath for zinc die castings?*

An excellent solution for plating copper or zinc die castings is as follows:

Metallic Copper	2.50	oz/gal.
Free Sodium Cyanide	1	"
Rochelle Salt	10	"
Sodium Carbonate	6	"

Either hang plate for buffing. Seg 10 to 15 minutes or just a strike and then bright nickel plate for 10 minutes.

3. *What is the effect of high carbonate content in copper baths?*

Sodium carbonate in a cyanide copper solution in excess of 6 oz/gal. reduces cathode efficiency, increases anode polarization.

4. *What is the effect of Rochelle salts on the metallic copper and carbonate determinations in a cyanide copper solution?*

In the determination of metallic copper in the presence of Rochelle salts some difficulty may be experienced in the decomposing of the sample with sulphuric and nitric acids due to the charring of the tartrate. If, however, the sample is decomposed with 100 volume peroxide and ammoniam this difficulty is obviated. In the carbonate

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Chowder Supper by Boston Branch

President Mintie will put on another one of his famous Chowder suppers for the members and their friends, Friday, May 14, 1937 at the Squantum Yacht Club, Wollaston, Mass. This will be an open meeting and a small charge will be made for the supper. If you are coming please notify the Secretary so that plans can be made to take care of all those coming.

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determination the presence of Rochelle salts tends to cause high results due to the occlusion of tartrate with carbonate precipitate. This error may be eliminated as follows:

In a measured sample precipitate the carbonate with barium chloride.

Filter, and wash well with hot water.

Transfer the precipitate to a clean beaker, dilute with water and titrate with normal acid and methyl orange.

Expel the carbon dioxide by boiling.

Cool, and titrate back with normal alkali and phenophthalein, deduct the alkali titration from the acid titration.

The corrected acid reading is then computed to sodium carbonate.

5. *Does the Rochelle salt break down to form carbonate in the solution?*

Rochelle salt is quite stable in cyanide baths.

6. *What can be used as a brightener or bright dip on die-cast metal where no polishing is required after brightness is obtained?*

Owing to the fact that die-cast alloys contain three or more different metals it is not practical to bright dip the surface. In view of the recently developed bright dips for pure zinc it would seem practical to prepare die castings by cleaning in a suitable bath which would deposit a coating of pure zinc and then bright dip.

7. *What is the best chloride concentration in a low P. H. nickel bath to give most efficiency and best corrosion of anodes? Also the effect of chloride on the porosity of the deposit?*

Chloride concentration has a definite effect on inter-crystalline corrosion of nickel anodes. When too high, small crystals of nickel are released, causing roughness and porosity in the deposit. When too low, the anodes become passive. A moderate concentration of chloride (2 oz/gal. Cl) is indicated.

8. *In the use of peroxide to control pitting, what would occur if too much peroxide is used?*

When used to excess in a nickel solution peroxide reduces the cathode efficiency. In extreme cases deposition is completely prevented. In any event peeling of the deposit is likely.

9. *Brightener for zinc barrel plating solution to give snow-white finish, also prevent staining.*

Brighteners for zinc barrel plating are practically all proprietory formulas. The best results seem to be obtained by the use of a combination of two of these patented products. Trade names will be furnished on request.

Meeting adjourned at 11 P. M.

B. F. LEWIS, *Acting Librarian*

T. C. EICHSTAEDT, *Sec.-Treas.*

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SPRINGFIELD BRANCH

The regular monthly meeting of the Springfield Branch A. E. S. was held Tuesday evening February 23, 1937, at the Indian Social Club. There were forty-four members and guests present.

As we were very fortunate in having Mr. George Hogaboom, of the Hanson Van Winkle Company as our speaker, the regular business meeting was dispensed with. Mr. Hogaboom gave a very interesting illustrated talk on, "What the Ammeter Tells". He very definitely proved that because of the many different combinations of solutions, that the ammeter was very misleading. He also said that the future trend was toward a set of standard solutions. After answering many questions from the members, he was given a rising vote of thanks.

The meeting was adjourned at 10:50 P.M.

The regular monthly meeting of the Springfield Branch was held Monday evening, March 22, 1937, at the Indian Social Club, with Mr. W. J. R. Kennedy in the chair.

The minutes of the previous meeting were read and approved.

A letter from the Lea Mfg. Co. was read and placed on file. A letter from the Chicago Branch, stating proposed changes in the constitution was read, after which it was put over to the May meeting for discussion.

A motion was made and carried, instructing Mr. Kennedy to write a letter of thanks to the President of the Indian Social Club for the use of the Club rooms.

The application of Mr. Tom Bowker, of the Wm. Bowker & Sons Ltd., of Sheffield, England, was read and took the usual course.

The meeting was turned over to Mr. Phillip Prouty, of the Westinghouse Electric & Mfg. Co., who conducted a question box. Many questions on cleaning were asked and answered by various members. At the conclusion of the meeting, Mr. Prouty was given a vote of thanks.

The meeting adjourned at 10:55 p.m.

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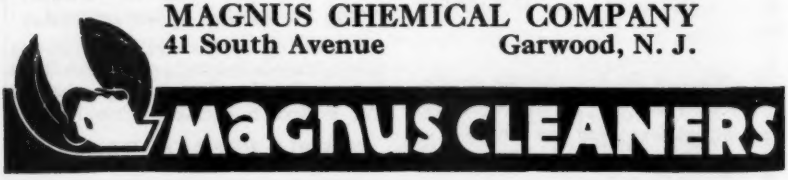

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Branch	Elected	Reinstated
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Hartford	9	
Springfield	8	
Dayton	6	
Toledo	6	1
Grand Rapids	5	
Pittsburgh	5	
Milwaukee	5	
Toronto	5	
Chicago	4	
New York	4	
Waterbury	4	
Montreal	3	
Philadelphia	3	
Newark	2	5
Binghamton-Elmira	2	
Cleveland	2	
Rochester	2	
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The Abstract Section

JAMES W. HANLON, *Chairman, Program and Educational Committee*

The Use of Rectifiers in Plating Shops. A. JULET. *Galvano* (Paris), Jan. 1937, page 17 — Rectifiers of various types have found widespread use in many fields. For plating requirements of low voltage and high current strength, only recently has a special type been perfected. This is the copper oxide rectifier, which now furnishes currents as high as 12,000 amperes in the plating range of voltages. This rectifier consists of combinations of copper-copper oxide elements mounted in one or more cabinets, of which the only moving part is a small ventilating fan. Transformers to reduce the voltage of the A.C. current before rectification, and push-button controls, which permit control at a distance are also required.

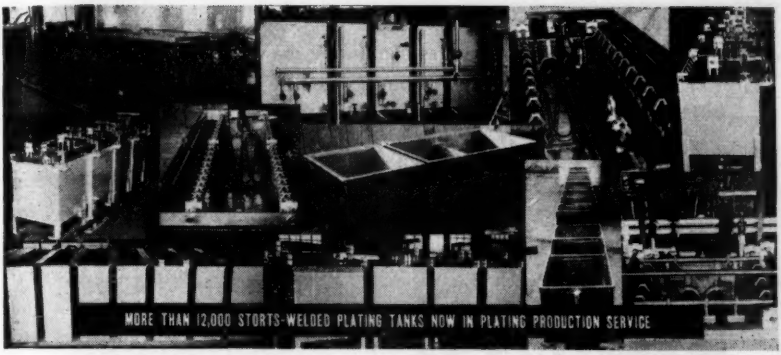
The rectified current has a ripple of about 7%, which ripple has no harmful effect. The rectifier elements are known to have a long life, some having already been in service more than five years. An aging effect causes a slight loss in power in the first year or two, after which the characteristics remain unchanged for a long period. (To be continued).

C. G. THOMAS

Control of Throwing Power in Electrolytic Baths by ALBERT M. PORTVEIN, *Metal Progress*, Vol. **31,** No. 2, Page 172, February, 1937 — The author suggests an easy and convenient way to determine the throwing power and efficiency of a plating bath by means of only two weighings. Two concentric coils 0.20 and 0.75 in. diameter made of 24-gauge wire, each coil having a surface of exactly 10 sq. cm. (1.55 sq. in.), are placed in the plating bath and they are held by means of ebonite discs. The piece is then plated and weighings are made before and after plating. The increase in weight p and P of the interior and exterior coils respectively is measured, and the throwing power is computed by the formula $\pi = 100\ p \div P$; the value π being only an arbitrary figure. The author finds by means of this method that those factors that shorten the time of plating such as increased temperature, high current density, or high concentration of the bath, decrease the throwing power.

WILLIAM GEISSMAN

Electrolytic Manganese, Extract from Annual Report, Jan., 1937, Metallurgical Division, U. S. Bureau of Mines, *Metal Progress*, Vol. **31,** No. 3, Page



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269, March, 1937 — Domestic ores containing manganese being of low grade had to have some special means for purification. The hydrometallurgy of the ores had been developed thoroughly, and electrolysis presented itself as the logical method. It was found that a bright deposit of manganese could be obtained from a solution 4 normal in $MnSO_4$ and 2 normal in MH_4Cl and in the presence of a small amount of SO_2. A complete regenerative system for the operation was constructed. The electrolyte was circulated from the catholyte to the anolyte to a mixing tank, where $MnCO_3$, representing the raw material, was added, which reacted to neutralize the partly spent anolyte. The solution then passed to a settling tank and completed the cycle by flowing into the catholyte space; wood was then used to separate the anolyte from the catholyte. Deposits 99.8% pure were obtained by this method at a current efficiency of 54%.

WILLIAM GEISSMAN

Non-Tarnishing Silver Plate Made by Alloying. By C. C. DOWNIE, *Metal Progress*, Vol. **31**, No. 3, Page 292, March, 1937 — To overcome tarnishing and discoloration of silver small quantities of metals of the platinum group are added to the plate. In the plating process, the anodes are of pure silver, and the rare metal additions were contained in the electrolyte. Nitrites, hyponitrites, and other "hypo" acids are used in the electrolyte which is kept under strict analytical control. No specific data on the baths are given. Although not comparable to indium plate, these silver-rare alloy plates are comparatively cheap, and whiter than chromium plate.

WILLIAM GEISSMAN

METAL CLEANING AND FINISHING

Bright Deposits, Thickness Control - Feature Plating Progress. By WALTER R. MEYER—Greatest progress has resulted from a better understanding of solution components, operating conditions and testing, control and utilization of electrodeposited coatings. Hard chromium on gauges, dies, molds, etc. has found wider application. The use of bright nickel at high current densities has steadily increased. Bright zinc has shown great technical and commercial development during the past year. Drop tests, microscopic and chord measurements, etc. for determining thickness, have been more highly developed.

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Control in Electrodeposition Processes — By A. W. HOTHERSALL, M. Sc.—Author discusses function of cleaning and electrodeposition processes. Control of all processes is essential to secure proper adhesion, insure deposits free of defects, attain particular physical qualities, etc. The role of the chemist in control and developmental work is stressed.

E. T. SHEEHAN

METALS AND ALLOYS

1. Control of Abrasive Dust — By FRED B. JACOBS — *Mill & Factory*, Vol. **19**. Aug. 1936 pp. 50-52 — *Part II* — The dust hazard attendant on polishing operations is discussed. In dry polishing operations such as roughing and dry finishing, the dust consists of metallic particles; in oil finishing, because of the application of grease or emery cake, dust particles are not so numerous. The dust from buffing operations is almost entirely lint from the wheel and is less with motor driven polishing and buffing lathes than with belt driven. Hood and blower installations for several types of polishing and buffing lathes are described and illustrated.

Part III. An adequate system for the collection and disposal of abrasive dust is composed of four major components: the hoods over the grinding, polishing and buffing wheels, the system of main and branch pipes, the fan for creating the air pressure in the system, and the collector that separates the dust from the air and deposits it in a bin for the purpose. Hoods of various designs are described and illustrated and the method of determining the required fan capacity is outlined. The legal aspects of dust removal, with especial reference to variations among state laws or regulations, is discussed.

PHIL J. RITZENTHALER

2. Anodic Treatment for Production of Aluminum Reflectors - N. D. PULLEN. *Journal Institute of Metals* - Vol. **59**: Aug. 1936, 393-400 — Describes a two bath process for treatment of Al surfaces to produce high reflectivity. First bath is an electrolytic brightening bath of sodium carbonate and sodium phosphate in ratio of 3:1. Second bath which produces film consists of solution of sodium acid sulphate. Data are given showing the reflectivity of Al surfaces treated by this method compared with standard Ag mirror and others such as chrome and nickel. PHIL J. RITZENTHALER

3. PLATING EQUIPMENT — Materials of Construction - EDWIN M. BAKER. *Metals and Alloys* - Vol. **7** Nov. 1936 - pp. 287-289 — Materials for tanks for various types of plating solutions, methods of anode contact and ventilating equipment for plating rooms are described.

PHIL J. RITZENTHALER

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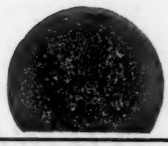

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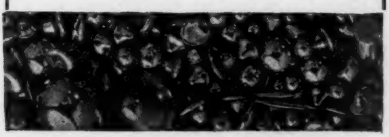

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Associate, Boston Branch

E. H. Witte, 321 N. Pulaski Rd., Chicago, Ill.
Active, Chicago Branch

J. E. Lorang, 65 S. Alfred St., Elgin, Ill.
Active, Chicago Branch

J. M. Schlosser, 3750 Sunnyside Ave., Chicago, Ill.
Active, Chicago Branch

M. F. Ehrler, 335 Gooding St., La Salle, Ill.
Associate, Chicago Branch

Claude Terrill, 4123 N. 25th St., Milwaukee, Wis.
Associate Milwaukee Branch

Ralph J. Paddock, 1601 Waldo Blvd., Manitowoc, Wis.
Active, Milwaukee Branch

Harvey W. Lubker, 3001a Ohio Ave., St. Louis, Mo.
Active, St. Louis Branch

Chas. P. Bacon, 321 N. 9th St., East St. Louis, Ill.
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Amandus Mueller, 3826 Washington Ave., St. Louis, Mo.
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Daniel Dowd, 2014 Delmar Blvd., St. Louis, Mo.
Active, St. Louis Branch

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Active, St. Louis Branch

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